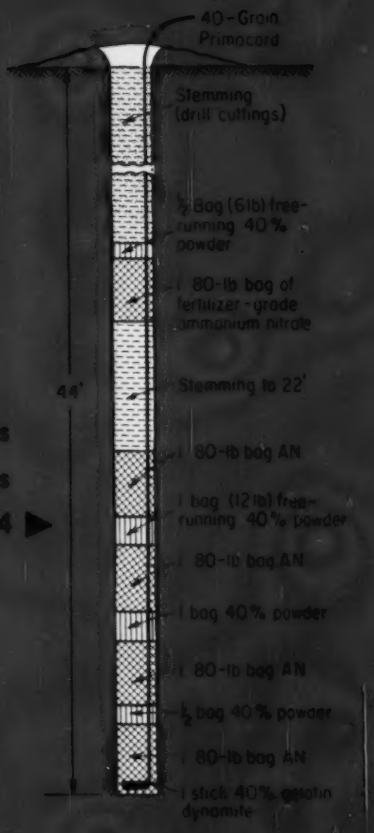
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

OCTOBER 1958

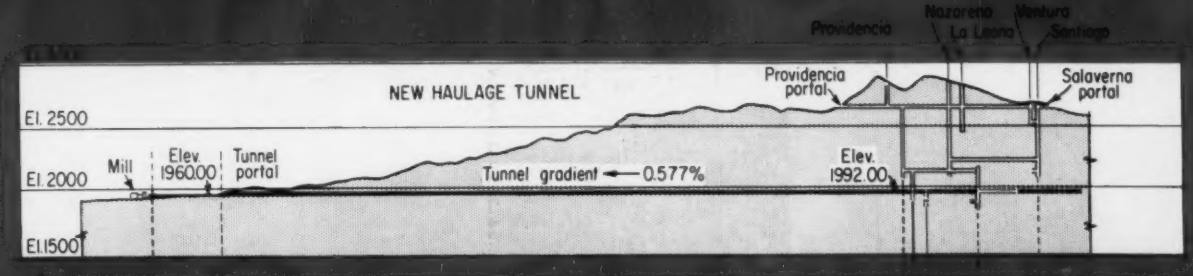
PRICE ONE DOLLAR

FOUNDED 1866


40-Grain Primacord
Stemming (drill cuttings)
½ Bag (61b) free-running 40% powder
1 80-lb bag of fertilizer-grade ammonium nitrate
44'
Stemming to 22'
1 80-lb bag AN
1 bag (12 lb) free-running 40% powder
1 80-lb bag AN
1 bag 40% powder
1 80-lb bag AN
½ bag 40% powder
1 80-lb bag AN
1 stick 40% gelatin dynamite

LOADING ammonium nitrate is going mechanical. p 90. Here's how Jackpile does it. . . . p104 ▶

◀ ROCK STRESS must be studied constantly. Here are some of the methods. p95



▲

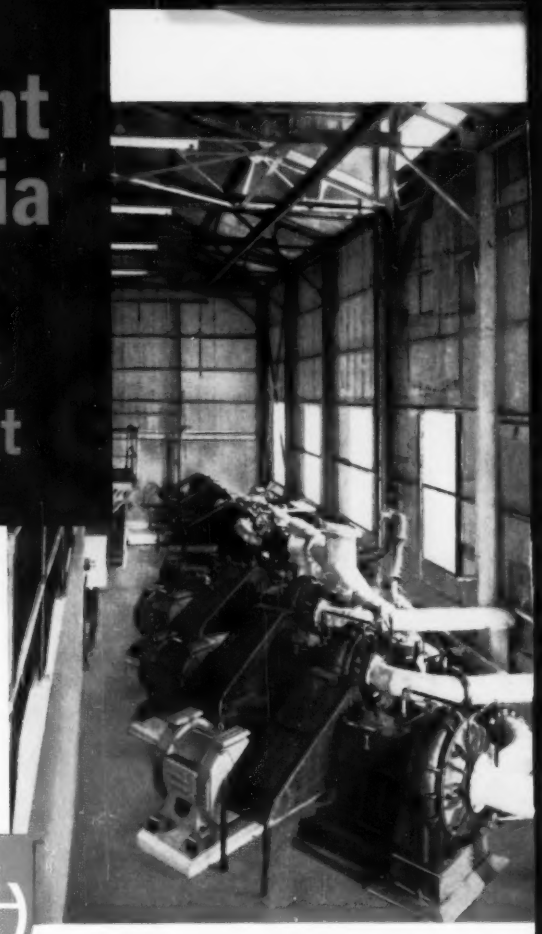
LONGER LIFE for a mine now in low grade is being accomplished at Peñoles' lead-zinc property in Mexico with the driving of a new four-mile haulage tunnel. . . . . p 86

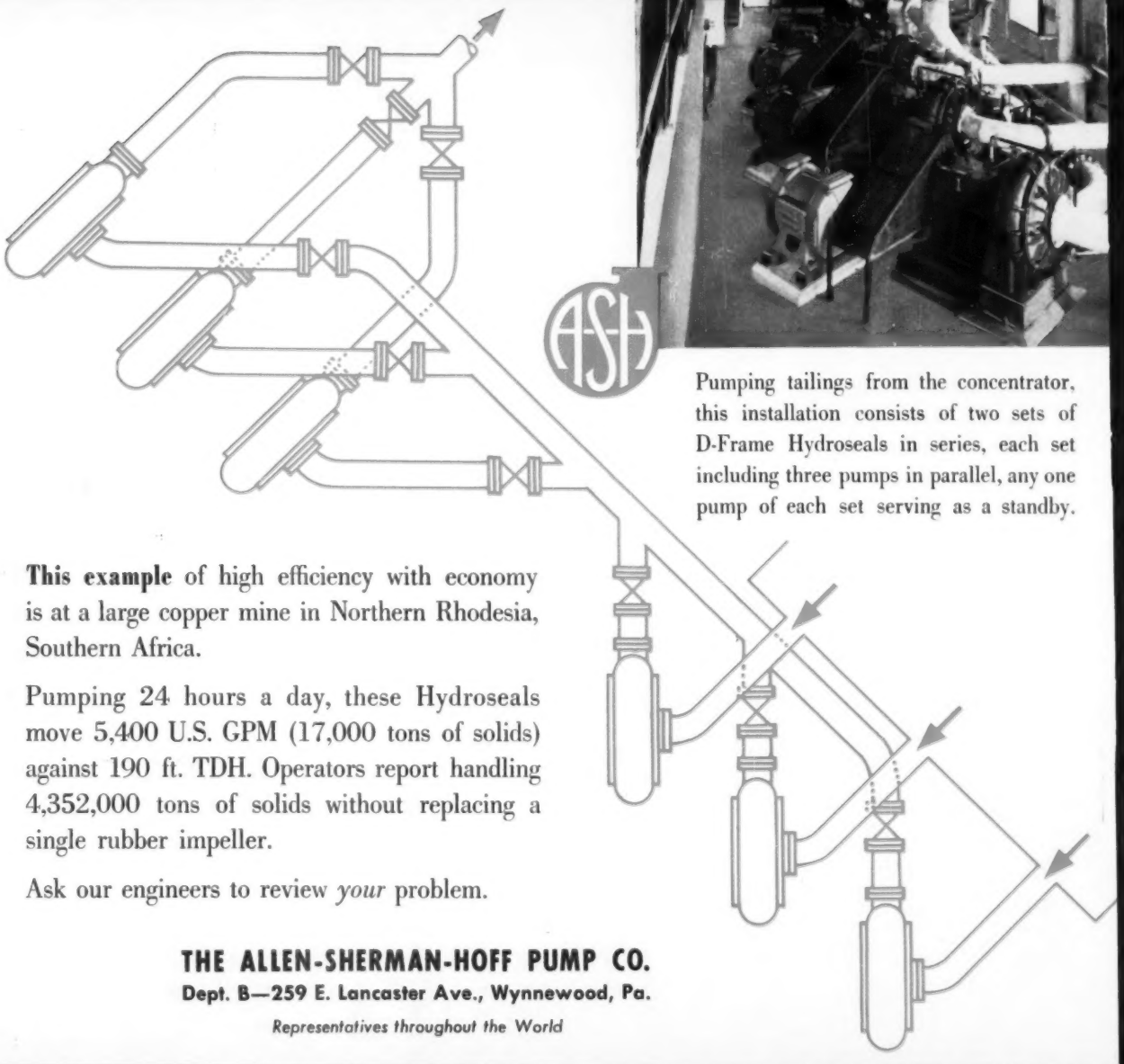
See complete contents page . . . p 2

Pumping achievement in Northern Rhodesia

Four operating Hydroseals do the work of 18 replaced pumps

and save 1/2 the power cost





Pumping tailings from the concentrator, this installation consists of two sets of D-Frame Hydroseals in series, each set including three pumps in parallel, any one pump of each set serving as a standby.

This example of high efficiency with economy is at a large copper mine in Northern Rhodesia, Southern Africa.

Pumping 24 hours a day, these Hydroseals move 5,400 U.S. GPM (17,000 tons of solids) against 190 ft. TDH. Operators report handling 4,352,000 tons of solids without replacing a single rubber impeller.

Ask our engineers to review *your* problem.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

HYDROSEAL and CENTRISEAL

SAND, SLURRY & DREDGE PUMPS

MAXIMIX RUBBER-PROTECTED

SOMETHING NEW UNDER THE GROUND

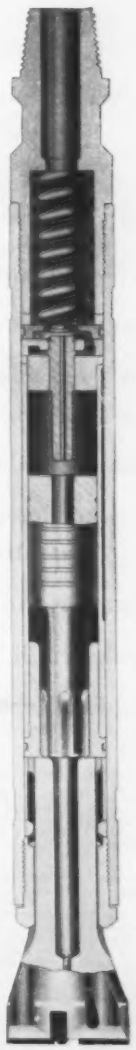
Revolutionary I-R
"DOWNHOLE" DRILL

service-proved on millions of feet of hole,
now available in FOUR SIZES,
with constant, thru-the-bit hole cleaning!

The I-R DOWNHOLE drill is a rugged, heavy-duty, sub-surface percussion drill that delivers full striking power *right at the bit.* Hundreds of units, in operation all over the world, have drilled millions of feet of hole with outstanding records of performance and economy.

Designed for use with Ingersoll-Rand Drillmaster and Quarrymaster drilling rigs, the DOWNHOLE drill is also available to present users of other types of rotary drilling equipment. Conversion from roller cone bits to DOWNHOLE drilling is simply a matter of screwing the drill to the rod or adapter and adding an air-line lubricator.

Here are some of the features that put the DOWNHOLE drill in a class by itself.



PATENTED HOLE CLEANING. All operating air is exhausted through the bit and additional *high-pressure air* blows continuously through the bit for maximum hole cleaning, even while drill is not running.

RENEWABLE WEAR SLEEVE. The entire unit is encased in a renewable wear sleeve that can be replaced at low cost when the outside diameter is worn down. (Patent Pending)

THREADLESS CARSET BIT DESIGN. The service-proved result of years of experimentation and field operation, it has no threads to strip or work loose and no energy loss through a separate connection.

SEALED UNIT. There are no ports in the outside of the drill which could admit abrasive material into the working parts.

CHECK VALVE. An optional check valve can be mounted behind the drill to permit operation under great heads of water—keeps mud and cuttings out of the machine even when the drill is stopped.

SPECIFICATIONS	DHD-275	DHD-325A	DHD-400	DHD-500
BIT SIZES	4¾" & 5"	6" & 6½"	7" & 7½"	9"
ROD SIZES (O.D.)	4"	4" & 5"	5½"	7"
LENGTH (BIT EXTENDED)	52¾"	52½"	63¼"	68½"
OUTSIDE DIAMETER	4¼"	5⅛"	6"	7¼"
WEIGHT (INCLUDING BIT)	158 lb.	236 lb.	362 lb.	586½ lb.

For further details, send for a copy of Bulletin 4203.

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

5-B64

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

ENGINEERING AND MINING JOURNAL

92nd YEAR OF PUBLICATION

OCTOBER 1958

VOL. 159 NO. 10

Behind the By-Lines	4	Markets	22
E&MJ Outlook	17	New Products Digest	43
This Month in Mining	18	Operating Ideas	118
Washington Impact	20	New U.S. Patents	122
		Personals	124

A New Type of Competition 85

New Four-Mile Tunnel Adds New Life to Peñoles' Avalos Lead-Zinc Mine 86

Better AN Loading = Even Lower Costs ..... Donald M. Stromquist 90

Tractor-Ripper Slices Frozen Ground 93

How to Measure Rock Pressures ..K. P. Gupta 95

An Ion Exchange Approach to Molybdic Oxide ..... Howard Cox and A. K. Schellinger 101

The Jackpile Mine—Revisited ..John B. Huttl 104

How to Determine Mica Content of Samples With Heavy Liquids ....C. Joseph Venuto 109

Postscript to the Rainier Blast 110

Broken Hill Tries Long-Hole Drilling 111

Bagdad Reports Haulage Costs ..John B. Huttl 112

Carl Consh .....Publisher

Alvin W. Knoerr .....Editor

Daniel P. Eigo .....Managing Editor

John B. Huttl .....Associate Editor San Francisco

Lloyd E. Antonides ....Associate Editor

James W. Franklin ....Associate Editor

Finn B. Domaas .....Assistant Editor

George H. Cleaver .....Market Editor

John R. O'Connell Jr. ..Assistant Editor Markets

F. Alvin Zimmerli .....Art Director

Ellen F. Kalhaus .....Copy Editor

John Donaldson ...Washington Bureau, Natural Resources

Alan E. Adams ....Washington Bureau, Labor

William H. McNeal ..Circulation Mgr.

Raymond H. Smalley ....Business Mgr.

News Bureaus: Atlanta 8; Cleveland 15; Detroit 26; Houston 26; San Francisco 4; Washington 4.

World News Bureaus: London, Bonn, Paris, Rio de Janeiro, Mexico City, Beirut, Tokyo, Melbourne. **World News Offices:** Stockholm, Manila, Buenos Aires, Caracas, Havana, Lima, Santiago, Montreal, Toronto, Vancouver, Johannesburg.

Published monthly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), founder. Publication Office: 3rd & Hunting Park Ave., Philadelphia 40, Pa. See panel below for directions regarding subscription or change of address:

Executive, Editorial, Advertising and Subscription Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, president; Joseph A. Gerardi, executive vice president; L. Keith Goodrich, vice president and treasurer; John J. Cooke, secretary; Nelson Bond, executive vice president, publications division; Ralph B. Smith, vice president and editorial director; Joseph H. Allen, vice president and director of advertising sales; A. R. Venezian, vice president and circulation coordinator.

Subscriptions are solicited only from executive management, engineering operating and supervisory officials associated with companies engaged in the exploration, mining, milling, smelting, refining and processing of metals and nonmetallic minerals except coal, oil and stone. Position and company connection must be indicated on subscription orders. Send to address shown in box below.

Subscription rates for individuals in the field of the publication: United States and possessions $4 a year; $6 for two years; single copy $1. Canada $5 a year; $8 for two years; single copy $1. Other Western Hemisphere and Philippines $8 a year; $12 for two years; $16 for three years; single copy $2. Elsewhere $15 a year; $25 for two years; $30 for three years; single copy $2.

Second-class postage paid at Philadelphia, Pa. Title registered in the U. S. Patent Office.

© Copyright 1958 by McGraw-Hill Publishing Co., Inc. All rights reserved. Printed in the U.S.A. Our primary aim is to provide subscribers with a useful and valuable publication. Your comments and suggestions for improvement are encouraged and will be most welcome. The publisher, upon written request from any subscriber to our New York office, agrees to refund the part of the subscription price applying to copies not yet mailed.

SUBSCRIPTIONS: Send subscription correspondence and change of address to Fulfillment Manager, ENGINEERING & MINING JOURNAL, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Since copies are addressed one or two issues in advance, please allow one month in sending notice for the change to become effective.

Postmaster: Please send form 3579 to Engineering and Mining Journal, 330 W. 42nd St., New York 36, N. Y.

B.F.Goodrich

It's a stomach pump for a coal mine

B.F.Goodrich improvements in rubber brought extra savings

Problem: Getting rid of pools of water that collect in this coal mine is a constant job. Let it accumulate, and in just a few days enough water could pour in to flood the underground pumps, damage machinery, close the mine down. At first, iron pipe was used to drain the pools. But the water contains acid that eats holes in metal. Flexible rubber hose, reinforced with wire, was tried, and worked fine until it was run over several times and crushed flat by heavy mining equipment.

What was done: When a B.F.Goodrich man heard of the trouble, he recommended a B.F.Goodrich hose that springs back to shape when run over. A continuous coil of hemp rope, specially treated and buried in thick rubber, makes this hose strong enough to stand the suction, yet flexible enough to spring back to its round shape after being crushed.

Savings: Since 1953, B.F.Goodrich water hose has worked night and day to keep this mine dry. It has gulped millions of gallons of acid water, been run over countless times by shuttle cars and other equipment. But despite the abuse, it lasts four times longer than the hose used before, saves an estimated 75% in maintenance costs.

Where to buy: Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich hose described here. And, as a factory-trained specialist in rubber products, he can answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Company, Dept. M-448, Akron 18, Ohio.*

B.F.Goodrich *industrial rubber products*

Behind the By-Lines...

This month we're taking a long look at the rock you don't take, as well as the rock you do take.

It may not show up on the balance sheet or the production records, but the rock you have to move everything through represents an expense.

That expense got to be too much for the management at American Metal-Climax's subsidiary in Zacatecas, Mexico, so the lads at Peñoles decided to do some plain and fancy by-passing.

The answer was a four-mile haulage tunnel at the 2,000 level, cutting right through to the present working area and avoiding a long hoist to a mountaintop and a subsequent aerial tram trip back down to 2,000 ft on the outside of the mountain.

Costs were rising, values were going down: but the Mexican government was sympathetic. Tax concessions from the latter, and discovery of some more low grade ore at the property finally came through and Peñoles' tunnel project is rolling.

Incidentally, the excellent three-dimensional drawing accompanying the article was given to *E&MJ* when we visited the property. It's a beautiful job. See p 86.

Probably the most expensive rock the underground miner has to cope with is the rock that doesn't stay where it's supposed to be.

There are several different ways of keeping track of your roofs and walls and, for your own safety and operating economy, you'd do well to check them all. Thanks to the kind offices of K. P. Gupta, of the Kolar Gold Fields, where they are deep enough to have run into some pretty terrific rock stress, you'll find a rather complete rundown of the various methods available. Equipment, application, use and the most likely results you can expect are all there, starting on p 95.

The rock you take is still our major interest, though, so we haven't been neglecting that either.

When ammonium nitrate blasting came on the mining scene, the industry was quick to pick it up and manufacturers were equally alacritous in providing ranges of type for various applications.

It has long been apparent that lower costs could be attained with AN. This month, we were tempted to headline an article "You Can Lower Costs Some More," but it didn't get past our copy editor.

Anyhow, we got it on p 90, and we recommend it most heartily. The story this time is on mechanical "at-the-hole," mixing and loading of AN, with emphasis on the mechanical.

We're sure this isn't the last word on loading technique, so, as even newer and better ideas come along, we'll keep in touch.

For one version of AN blasting as it should be done, we offer the article on Anaconda's Jackpile mine, which starts on p 104.

Blasting in this case is only a part of the complete story of one of the most exciting uranium projects in U. S. mining history. You'll get the whole story, from aerial discovery through mine, mill and plant this time, with some interesting dope on sampling and a mill feed control system that starts at the bench.

To wrap up the study on the cost of rocks, you'll find some of the most valuable and informative data now available on the subject of truck haulage in the article on Bagdad Copper's haulage methods.

It's no simple narrative of equipment and job, but a real cost-performance-value study, full of fact and figure.

The whole shebang starts on p 112. P.S.—There's a piece on AN blasting in this article, too.

One of the brightest of the regular communiques that is delivered to our cell is the *TDM Bulletin*, published monthly by the Territory of Alaska's Department of Mines. (We hope the acceptance of the new 49th State doesn't portend any change in its excellent operation.)

The *Bulletin*, along with reporting the vital news from Alaska, also manages to include a sparkle or two to brighten the day, or a sympathetic tone when that is called for.

An excellent example of the latter appears in the September report:

"Devamin Co., drilling the nickel deposits on Yakobi Island, recently put through a rush order to the States (the original 48, that is) for a new rotor for their helicopter.

"It seems that one of the drillers, in loading or unloading the 'chopper' while the rotor was spinning, accidentally raised one end of a 20-ft length of drill rod too high. Transportation was somewhat curtailed until a new rotor arrived."

That could become the 1958 equivalent of "Hey, little girl, get away from them swinging doors.!"

Our old friend the beachcomber did a little heavy research during his most recent trip. The itinerary began with the old Howard in Boston, hit the "Troc" in Philly and continued on through East St. Louis, Bourbon St., and Las Vegas.

His recent report, received while he was still en route, discusses what he considers an interesting trend in the sobriquets being adopted by some of the nation's more active strip tease dancers. (He notes here that Miss G. Rose Lee, in a recent pronouncement, expressed horror at the more scholarly title, "ecdysiast," coined by H. L. Mencken. "Strippers we are," observed Miss Lee, "and strippers we should be called.")

The beachcomber, however, is concerned with specifics rather than generics. "The ladies," he notes, "seem to be going in for elemental names. I encountered, vicariously, two Stormys, three Gales, one Hurricane, one Blaze, three Flames, and one Tornado.

"After considerable thought, the unimpassioned observer is left with a double wish:

"That the elements could be made a little more inhibited, and the ladies a little less perfunctory."

CAT D8 TRACTOR-NO. 463 SCRAPER DIGS PROFITS OUT OF ALABAMA QUARRY

Cat D8 Tractor-No. 463 Scraper stripping overburden in mining operation near Tarrant, Ala. The haul averages 300 ft.

"I like the performance of our Caterpillar equipment," says John N. Cushman, general superintendent of the Dolcito Quarry Co., Tarrant, Ala.

Mr. Cushman is praising a Caterpillar team that is daily producing in excess of 2,000 tons of dolomite used for concrete aggregate, agricultural limestone, fluxing stone and rock dust.

A Caterpillar D8 Tractor with No. 463 Scraper strips overburden that ranges from 12 to 28 ft. thick. A Marion Back Hoe powered with a Cat D315 Engine assists in this function. The stone then is shot at a depth of about 50 ft., and a D7 pushes the rock to the quarry floor.

The D8-No. 463 combination is ideal where power and traction are needed for a short haul. The No. 463 Scraper, with all the fast, easy loading characteristics of LOWBOWL design, has a capacity of 18 cu. yd. struck, 25 cu. yd. heaped. It has straddle-mounted rear wheels with adjustable axles, high apron lift, protected cables—all the features that have made Caterpillar LOWBOWL Scrapers famous for high production.

The D8 packs 191 flywheel horsepower and 155 HP at the drawbar. It's tough, from track shoes hardened by a "water-quench" process to rugged diesel engine that uses low-cost fuels without fouling. And you have your choice of two models: torque converter drive and direct drive with the exclusive Caterpillar oil clutch.

Your Caterpillar Dealer has facts and figures showing how these big yellow machines can make a quarry operation more profitable. Ask for a demonstration.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

FIND YOUR CATERPILLAR DEALER IN THE YELLOW PAGES

THE NO. 1 TRACTOR-SCRAPER COMBINATION

Get "springtime starts" all year round

TEXACO OLYMPIAN GREASE won't thick up in winter, thin out in summer—gives trains the same easy starts 12 months a year

You don't have to strain your engines getting trains started on a cold winter day—or worry about grease oozing out in summer. Special properties of Texaco Olympian Grease keep it at the right consistency all the time. Furthermore, it has a high resistance to oxidation, and won't separate in service or in storage. It's bound to give longer life to your bearings.

For your wire rope and open gears, use Texaco Crater or (for spray application) Texaco Crater X Fluid. They protect both strands and core, keep wire rope strong longer. They cush-

ion shocks and permit heavy loads, prolong open gear life.

Let your local Texaco lubrication representative show you how Texaco products can help lower your maintenance costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write to:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

Now 250 manufacturers

—INCLUDING THESE BUILDERS OF

OFF-HIGHWAY HAULERS AND CRANE CARRIERS

DITCHERS, GRADERS, ROLLERS AND STABILIZERS

PUMPS

EXCAVATORS, CRANES AND HOISTS

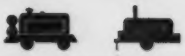
offer "Jimmy" Diesel

CONSTRUCTION AND MINING EQUIPMENT

TRACTORS, SCRAPERS AND LOADERS

WESTINGHOUSE LT · PETTIBONE · CURTISS-WRIGHT SOUTH BEND DIVISION · OLIVER · TROJAN A YALE PRODUCT · EUCLID · EIMCO · MICHIGAN

AIR COMPRESSORS AND WELDERS



GARDNER DENVER · LINCOLN ARC WELDING EQUIPMENT · JAEGER · LE ROI · JOY · HOBART WELDERS · BLUE BRUTE · POWER VANE · Ingersoll-Rand

CRUSHERS, ASPHALT PLANTS AND PAVERS

Cedarapids Built by IOWA · LEW · ROGERS JOPLIN · A-M · BLAW-KNOX · Pioneer EQUIPMENT · TELSMITH · KOEHRING HEAVY DUTY · LIMA · STANDARD · H&B · BALDWIN BLN · Barber-Greene · CHAIN BELT REX COMPANY · PETTIBONE UNIVERSAL · DIAMOND · GUNTERT & ZIMMERMAN

Registered trade marks are reproduced with permission of the manufacturers.

GM Diesel engines are available in more than 1800 different applications of power equipment

Mining operators agree that engine standardization pays big dividends. The wide use of GM Diesel engines in more different makes of equipment than any other Diesel provides unequalled opportunities for standardization—and the fact that GM Diesel covers the range from 30 to 893 H.P. with *only 3 cylinder sizes* results in highest parts interchangeability, lowest maintenance cost. Write for booklet, "STANDARDIZE YOUR POWER"—and learn the reasons why.

DETROIT DIESEL ENGINE DIVISION OF GENERAL MOTORS, Detroit 28, Michigan

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario

GM
GENERAL MOTORS
DIESEL POWER

IT PAYS TO STANDARDIZE ON...

3-YARD HIGH-LIFT STRIPPER*

Digging height . . . 42′-10″
Dumping height . . . 31′-5″
(40′ boom at 45° angle)

Look at the work range of this big stripping shovel! It's the high-lift 1205 — a recent addition to Koehring® heavy-duty line. When equipped with 3-yard dipper on 40-foot boom, it has 42-foot-10-inch cutting height at 45° boom angle — and dumps at a height of 31-feet-5-inches. That's not all —

Higher with 50′ boom

When extra reach is needed, Koehring high-lift 1205 handles a 2½-yard dipper on 50-foot boom. This gives you 51-foot-4-inch cutting height — and a 40-foot-10-inch dumping height, at 45° boom angle. (For heaviest digging a standard 1205 has 3-yard shovel dipper on 30-foot boom.)

The 1205's power, strength, and load-stability also pay off in extra work capacity on dragline stripping and clamshell stockpiling. Depending on weight of materials, it handles 3 to 4-yard dragline or clamshell buckets on 60 to 170-foot boom. As a lift crane, it has 95-ton capacity (based on 75% rating). For all its size and capacity, the high-lift 1205 is exceptionally easy-operating. 90% power-assist on main drum clutches gives light lever pull, sensitive "feel" of load — helps get more work done with every attachment. Get complete details from Koehring distributor *today*.

K843

* In a recent analysis of new equipment developments for the mining industry, Koehring 1205 high-lift stripper (above) received a top award in the open pit category. It was judged by representatives from leading mining and contracting firms in a review for *Mining World*, *World Mining* magazines.

Below is another big Koehring stripper worth looking into — the heavy-duty 805. As a dragline or clamshell it handles 2 to 3-yard buckets on wide work radius. Boom lengths: 50 to 150 feet. Converts to 52-ton crane for heavy lifting — and 2-yard shovel (with 25-foot boom) for heavy digging.

KOEHRING DIVISION OF KOEHRING COMPANY, Milwaukee 16, Wis.

Instantaneous
GRAVITY DUMP

Any time quick dumping action is needed, operator releases fast by-pass of fluid in hydraulic cylinders . . . *gravity* takes over . . . dumps load *instantly*. Hydraulic cylinders check body-tilt at 65° angle . . . have same cushioning action when dump body is returned to normal hauling position.

Controlled
GRAVITY DUMP

During a *full-controlled* dump cycle, hydraulic system acts as a retarder. *Gravity* actually tilts the body . . . hydraulic pressure *controls* the rate of discharge, or *holds* the dump body in any desired position . . . *No body-hoist!*

You get both in new 10-YARD Dumptor!

Plus → PIVOTING SEAT for 2-direction travel

Operator always faces direction of travel . . . swings around *without leaving seat*. Dual steering wheels, throttle, brake pedals are located at both operating positions of pivoting seat. Directional travel and speed-range lever, and the dump controls are centrally-located for convenient 2-way operation . . . no-turn shuttle hauling.

Big things have happened since you last looked at Dumptors. A new, 10-yard Model 100, with 30,000-pound payload capacity, has been added to the Koehring® line. In addition to its dual dumping advantage, and new two-way controls for no-turn shuttle hauling, you also get: speeds up to 20 m.p.h. in either direction • speed-range selections controlled by easy-acting hydraulic clutches • constant-mesh transmission with smooth torque-converter drive • power steering • 28½% gradability, and many more advantages for low-cost, heavy-duty hauling. A smaller, companion-model 6-yard Dumptor® is also available. Why wait? Call Koehring distributor *today!*

KOEHRING
DIVISION OF KOEHRING COMPANY

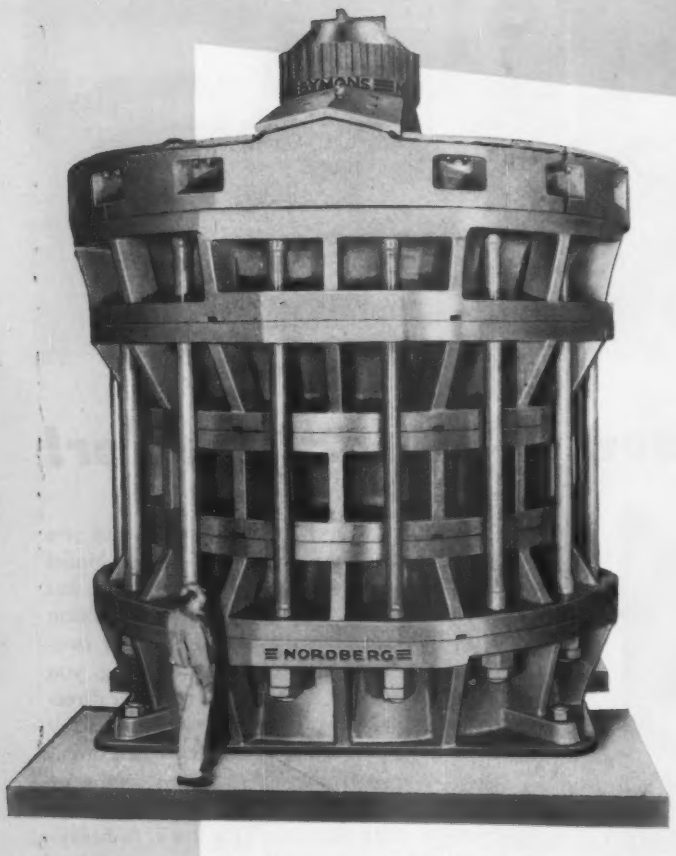
Milwaukee 16, Wisconsin

KOEHRING HEAVY DUTY

K849

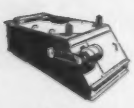
SYMONS®

GYRATORY AND
FOR PRIMARY AND

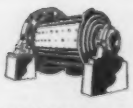


SYMONS 60" GYRATORY CRUSHER

SYMONS 42" GYRATORY CRUSHER



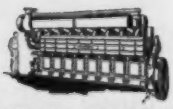
SYMONS
VIBRATING SCREENS



NORDBERG BALL,
TUBE AND ROD MILLS

SYMONS
VIBRATING GRIZZLIES

NORDBERG
MINE HOISTS

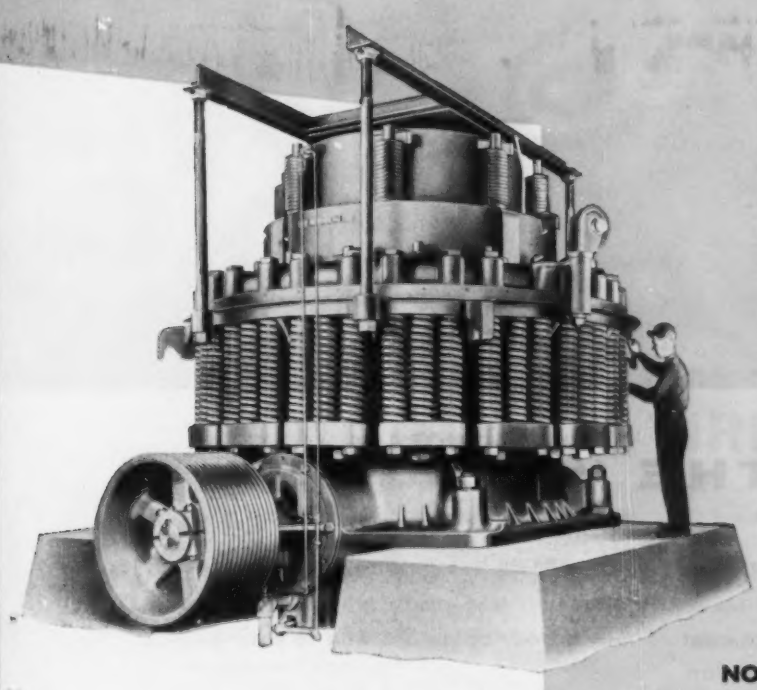


NORDBERG DIESEL—DUAFUEL® and
SPARK-IGNITION GAS ENGINES

CONE CRUSHERS FINE REDUCTION

... give you greater productivity through more efficient crushing

... built in a complete range of sizes for capacities to over 3500 tons per hour



SYMONS 7′ EXTRA HEAVY DUTY CONE CRUSHER

All over the world, for big tonnage requirements and heavy duty crushing operations, Symons Gyratory and Cone Crushers are the outstanding choice of the mining and quarrying industries . . . because they *assure maximum and continuous production at low operating and maintenance costs.* For heavy duty primary breaking, Symons Gyratory Crushers are available in 30″, 42″, 48″, 60″ and 72″ sizes, for capacities up to 3500 and more tons per hour. For secondary and finer reductions, Symons Cone Crushers, in both Standard and Short Head types, are available in sizes ranging from 22″ to 7′—in capacities from 6 to 900 or more tons per hour.

Write for further information—Nordberg stands ready to serve you.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

© 1958, Nordberg Mfg. Co.

C458

SYMONS . . .

A REGISTERED NORDBERG TRADEMARK

KNOWN THROUGHOUT THE WORLD

NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

AT HOME ON THE "RANGE"

If there's an 8-yard mining shovel in your future, make it a Marion 181-M.

Here's a husky machine with the traditional strength, power and endurance of Marion mining shovels—plus small machine cycle time for an extra payoff every day.

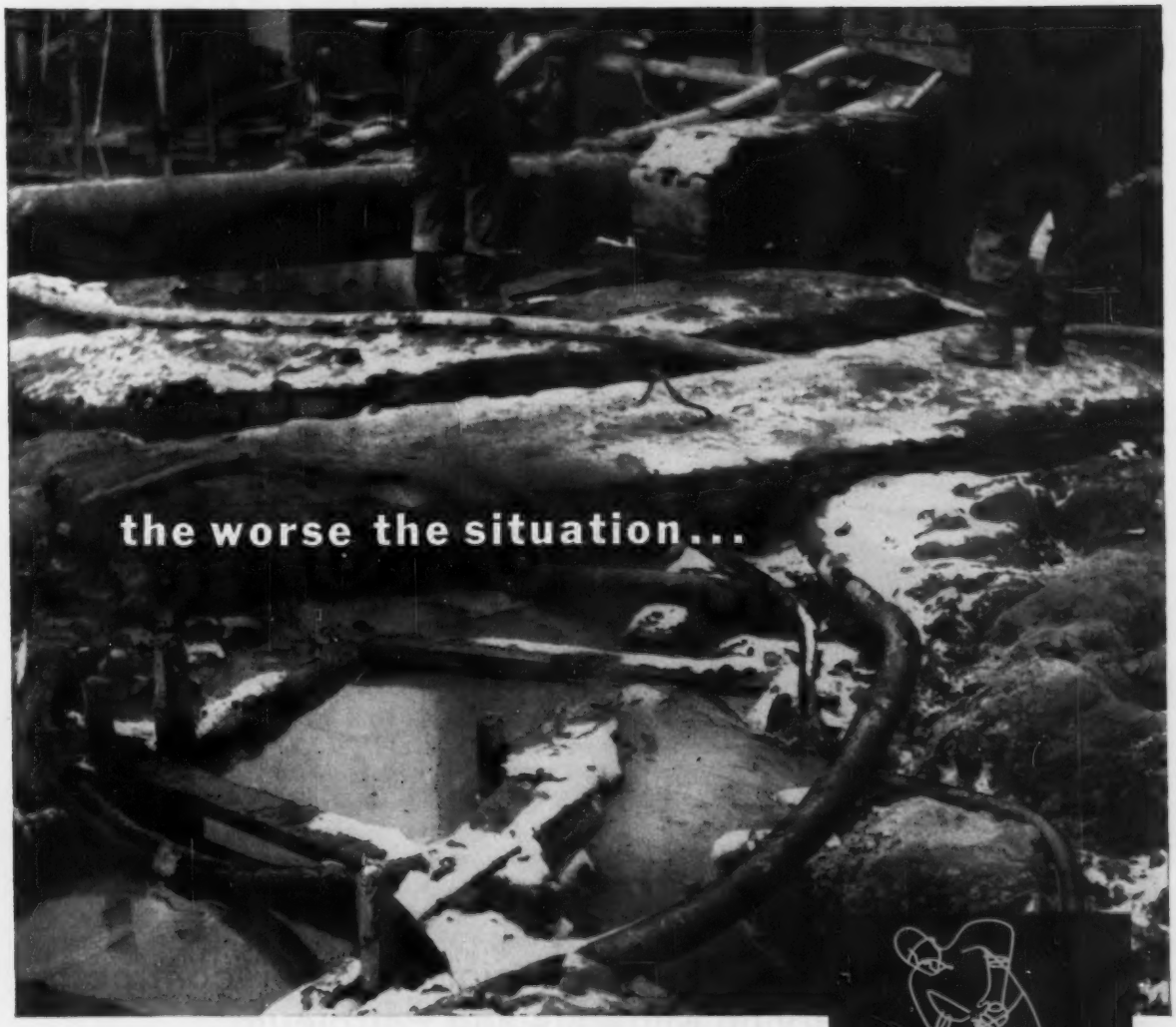
The 181-M has a combination of design, construction and performance features that can lower your costs and add to your profits.

If you haven't seen Bulletin 439 on this 8-yard Marion, write for your copy today.

You get **MORE** *with* **MARION**

MARION POWER SHOVEL COMPANY • Marion, Ohio

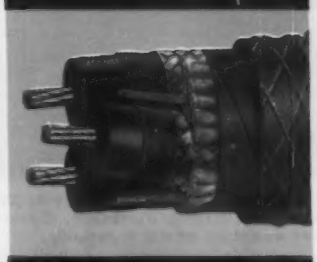
A Division of Universal Marion Corporation

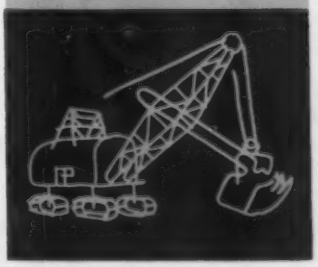


the more reason for using TIREX®

TIREX cords and cables give longest service when not subjected to severe abuse. But when required, TIREX can take it. In snow and mud, under water and under pressure, TIREX cords and cables remain flexible, smooth, light and easy to handle, thanks to their original cured-in-lead construction. They won't snag or tear, and their fortified and tempered neoprene armor gives balanced resistance to abrasion, water, acids, oils, sunlight and flame.

Millions of feet of TIREX are on the job everywhere—transmitting power for mobile mining equipment, construction machinery and portable tools.



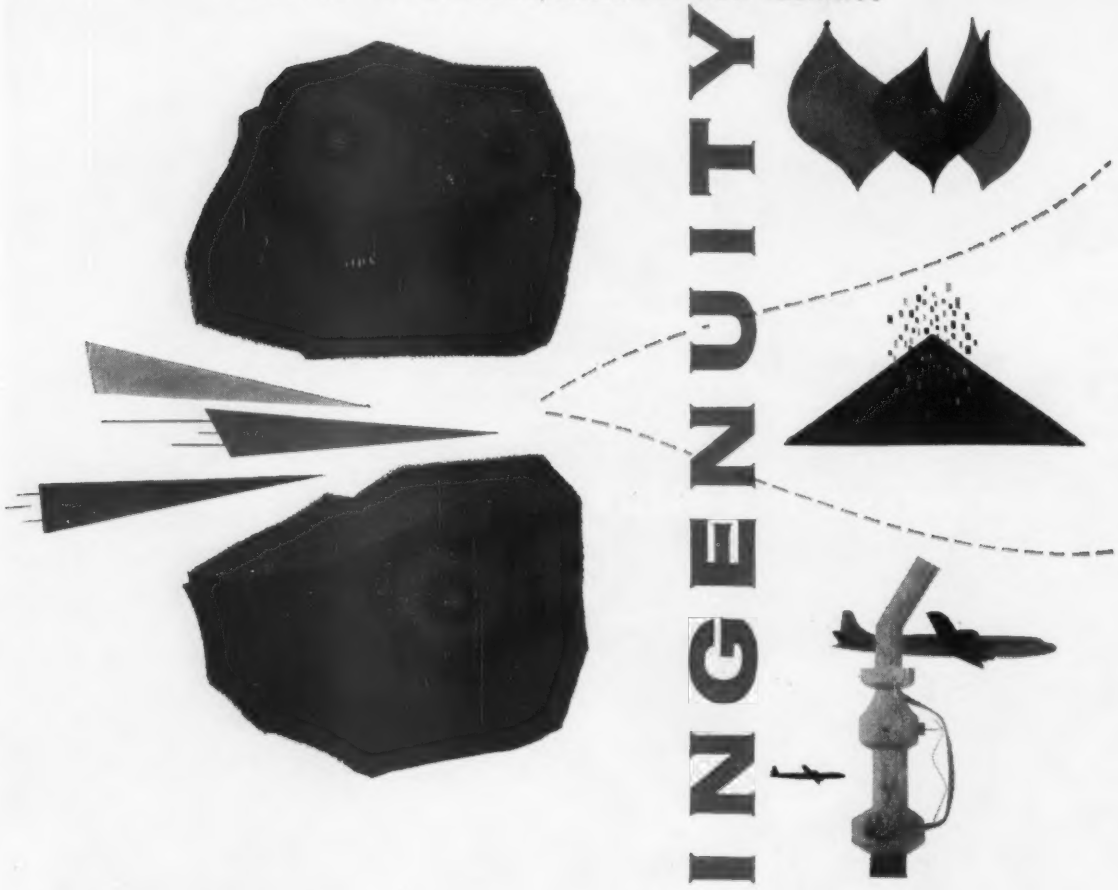


Simplex WIRE & CABLE COMPANY

79 SIDNEY STREET, CAMBRIDGE 39, MASS.

"The American manufacturers of transoceanic telephone cables"

call KE for plant expansion or new facilities



has made KE a major engineer-contractor serving Minerals and Petroleum

Nation's pioneer major commercial Gilsonite refinery near Grand Junction, Colorado... Another example of KE ingenuity.

Ingenuity at work—at American Gilsonite, Kaiser Engineers designed and built an enclosed, controlled-atmosphere calciner with associated power and plant equipment making possible 100% utilization of raw Gilsonite. First major all-commercial Gilsonite refinery built, the new plant produces 99.50% pure coke, extreme purity gasoline, and uses gaseous residue to power the entire facility.

From economic analysis through start-up, KE builds ferrous, non-ferrous, industrial minerals and petroleum processing plants; brings valued experience to every phase from mining and beneficiation to transportation and materials handling.

Let KE ingenuity save time and money for you. With your first thought of new facilities or expansion, call KE.

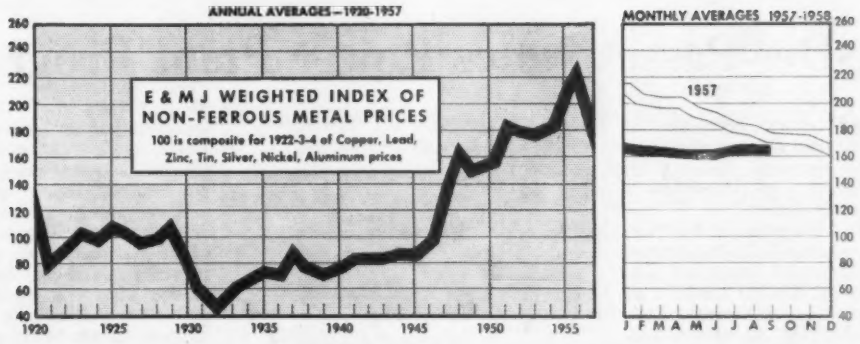
KAISER ENGINEERS engineers—contractors
Contracting since 1914

4385

Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D.C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

E&MJ OUTLOOK

PRICES



MARKETS

E&MJ's nonferrous metals price index remained virtually unchanged, dropping slightly from 168.36 for August to 168.29 for September. Lower copper and tin prices inched the index downwards.

●

AT HOME

New discoveries through research and product development will double production of borates during the next ten years, predicts J. F. Corkhill, general manager of United States Borax & Chemical Corp.'s Pacific Coast Borax Co. Div.

This year, the American iron and steel industry will complete eight large sinter plants at an estimated cost of $105-million. Robert C. McDowell, president of McDowell Co., Inc., reports that sinter capacity will be increased from 30-million to nearly 60-million tons during the 1954-58 expansion period. He expects the expansion program to continue through 1965 or beyond.

Office of Civil and Defense Mobilization announces that only four materials will be purchased for national stockpile during fiscal 1959—amosite asbestos, small diamond dies, muscovite block mica and film mica. An OCDM appropriation of $3-million is available for the upgrading of the following stockpiled materials by private companies: oxygen-free copper, ferromolybdenum, ferrovanadium, molybdic oxide and tungsten-carbide powder.

Wisconsin's Governor Vernon Thomson predicts that three or four large taconite operations will locate in the state, investing between $150- and $200-million in the Ashland-Hurley-Park Falls area.

Reserve Mining Co. has returned to a seven-day week at its Babbitt and Silver Bay operations in response to a pickup in demand for taconite pellets.

Mine owners and operators with taxable years ending after Dec. 31, 1953, may be entitled to more favorable percentage depletion rates permitted by the 1954 Code. Write to International Revenue Service, Public Information Service, for "Technical Information Release, TIR-96," for details.

●

LABOR

The giant Steelworkers union promises a hefty set of demands in wages and fringe benefits for next year. If past patterns are repeated, 1959 will be a costly bargaining year for the nonferrous metals industry as well (see p 21).

●

ABROAD

Philippine Republic has amended the Nickel Act to encourage foreign mining companies to seek concessions on the Suriago laterite deposits in northern Mindanao. International Cooperation Administration and the Philippine Bureau of Mines have worked for several years to disclose large ore reserves and develop treatment processes.

Venezuela Development Corp., a government agency, is budgeting $1.5-million for preliminary bauxite reduction plant studies near San Felix on the Orinoco River. Reduction capacity would be 50,000 tons of aluminum annually.

THIS MONTH IN MINING

Chute-Des-Passes Notes Power Plant Progress

FIVE HUNDRED MILES northeast of Montreal, in the bush country of French Canada, two thousand construction workers are pushing to completion a unique engineering project.

Here, at "The Waterfall of the Narrows," a powerhouse is being built—completely underground—which will generate 1-million hp for the smelters of the Aluminium Co. of Canada, Ltd., principal subsidiary of Aluminium Ltd.

To tap the waterpower potential of the Peribonka River, a six-mile tunnel is being driven through rock to funnel rushing water into the turbines of five huge generators, largest of their type ever built.

Begun in September of 1956, the Chute-Des-Passes project of Aluminum Ltd. is scheduled for completion in March, 1960, at an estimated cost of $140-million. Engineers expect the first power to be generated at the plant by August of next year.

Visitors of Chute-Des-Passes arrive by airplane, landing on the 4,000-ft landing strip hacked out of the woods. Or, they drive in over a 150-mile highway which had to be built through the forests before heavy construction equipment could be moved in.

The project uses a reservoir already created by the Passe Dangereuse Dam built by the company in 1945. The dam taps off water about 200 yards above this dam on the Peribonka River. Previously the water was released to supply two power dams 100 miles downstream, which still is the case except that under the new system it will first pass through the tunnel to the underground power station at Chute-des-Passes and then empty again into the same river.

Construction of the 34-ft dia horseshoe-shaped main tunnel, six miles long and tunnelling out the powerhouse cavern was a task of considerable magnitude. Over 3-million cubic yd of rock had to be drilled, blasted and trammed, and nearly half-a-million cubic yd of concrete were poured to line the tunnel and powerhouse chamber.

By using a tunnel six miles long, a head or vertical drop of water of 630 ft will be obtained which is capable of creating 1-million hp. This will bring the company's hydroelectric system in the Saguenay up to a total capacity of 3,580,000 hp.

Access to the underground workings was obtained by excavating three entrance tunnels from which it was possible to work in two directions at each heading. Another two mile tunnel was driven from the powerhouse downstream to provide discharge for the water, incorporating the unusual feature that it passes underneath the river into which it eventually discharges. The shorter tunnel is left unlined and is 48-ft dia, but the main 34-ft tunnel is concrete lined.

Another principal feature, which has been seldom attempted elsewhere in the world, is the method of building the intake to the tunnel at the bottom of the reservoir near the dam. This intake is 130 ft below the water level and projects 600 ft under the reservoir. A 100-ft dia plug, 50 ft thick, will be blasted out in one shot at the end of the intake tunnel with the rock from the blast falling into a hole previously excavated and large enough to hold 15,000 cubic yd of rock.

The hydro project has a surge tank to adjust changes in water demand and also to take up the backlash of water in the event some emergency requires closing down the powerhouse suddenly. The surge tank is about 2,000 ft upstream from the powerhouse and consists of a 130-ft dia tank, 250 ft high, connected with a 35-ft dia shaft, 300 ft long, and also excavated out of solid rock. An overflow basin in the form of a channel also in solid rock is provided to store 2-million cubic ft of water if required.

From the main tunnel the water will be fed by five 14-ft dia steel-lined tunnels or penstocks leading into the powerhouse. The latter is a vast chamber 465 ft long, 70 ft wide and 70 ft high, located 500 ft below the surface. The power chamber has a concrete arch ceiling with two 210-ton overhead traveling cranes spanning the powerhouse. The penstocks form a manifold which feed into five turbine generator units each rated at 200,000 hp. Another manifold will receive the discharge water on the other side of the powerhouse. Instead of concreting the discharge tunnel, aluminum rock bolts have been driven into the walls, 120,000 bolts being used in all.

Aluminum bus bars will carry the power from the generators through vertical shafts to the surface 500 ft above, terminating at an outdoor substation. To service these, a 500-ft elevator is being installed and will provide access to the powerhouse. Another permanent access will be through an access tunnel used in construction which starts near the bank of the Peribonka River and descends 120 ft along a curving route. Two high tension lines will carry the 345,000-v power over transmission towers 100 miles south to the Isle Maligne terminal station to join the Alcan transmission system.

A village, which is under construction on the banks of the Peribonka River above the powerhouse, will be the permanent townsite. A very modern school, with a large gymnasium and community hall, has been built and new houses will be constructed; but many of the houses presently used by families on the site will be moved to the proper locations. There is already a community clubhouse and a curling rink as well as a baseball diamond that doubles as a hocky rink in winter.

India Hopes For Greater Iron And Steel Output

WITH THE LIGHTING of the first 35 ovens of the 70-unit coke oven battery at the German-aided $357-million Rourkela steel plant and the prospect of pig iron production beginning both at Rourkela and at the Russian-aided Bhilai steel plant by the end of 1958, India's prospects for increased iron and steel production have improved considerably.

Set up by the German D. C. Otto & Co., Rourkela's battery has cost India about $16.8-million. According to the German firm's representative, government-owned Rourkela will have 210 ovens by 1961, carbonizing 5,000 tons of coal daily.

In order to supply Rourkela with the iron ore required, a mine is being built by a U.S. firm, 45 miles from the plant site. A government-owned coal washery is being completed to supply this steel plant with 160,000 tons of metallurgical coal. Situated at Kargali, about 214 miles from Rourkela, this coal washery will cost over $4.9-million. It will also supply the Russian-aided Bhilai steel works with ½-million tons of washed coal.

The $275-million Bhilai steel plant, now in its final construction stage, is expected to begin operation early in 1959—the entire plant being slated to be commissioned by December 31, 1959. When in complete production, Bhilai will produce 1-million tons of ingots.

Iron ore for Bhilai is being developed at the Rajhara mines. Five thousand tons of mechanical equipment are expected to arrive shortly from Russia for complete mechanization of these mines, which are estimated to yield around 2-million tons of iron ore. Pending the complete mech-

anization of these mines, float ore collection has started already. Mine operations will require 700,000 kw of power.

By the end of 1959, production of saleable steel is expected to rise to 1.8-million tons and of pig iron to 1.25-million tons. Corresponding 1958 estimates are: 1,450,000 saleable steel and 320,000 tons of pig iron. These increased production estimates are based, of course, also on the certainty of the expansion programs of the privately owned Tata Iron and Steel Co. and Indian Iron and Steel Co. being completed. Saleable pig iron output in 1957 amount to 383,000 tons.

Sweden Will Build A New Uranium Extraction Unit

A URANIUM EXTRACTION PLANT will be built at Ranstad in the western province of Vastergotland, Sweden. Quarrying 900,000 tons of Mount Billingen shale, the plant will produce 120 tons of uranium annually. The unit is scheduled for completion in 1962, at a cost of 115-million kroner. Sweden already has a uranium refinery at Kvantorp, in Narke province, which last year produced 10 tons.

Mining Calendar

Mid-American Minerals Conference, Society of Mining Engineers, AIME, Chase and Park Plaza Hotels, St. Louis, Mo., Oct. 23 to 25.

Metallurgical Society, AIME, Fall Meeting, Detroit, Mich., Oct. 27 to 30.

International Mining Days, New Mexico Mining Association and Southwest International Mining Association, Carlsbad, N. M., Oct. 20 to Nov. 1.

Galvanizers Committee, American Zinc Institute, Pick-Roosevelt Hotel, Pittsburg, Pa., Nov. 6 and 7.

Lead Hygiene Conference, Lead Industries Association, Drake Hotel, Chicago, Ill., Nov. 6 and 7.

Fourth Annual Symposium on Mining Research, Missouri School of Mines, Rolla, Mo., Nov. 13 and 14.

Minnesota Section, AIME, annual meeting, Hotel Duluth, Duluth, Minn., Jan. 12 to 14.

Tenth Plant Maintenance & Engineering Show, Public Auditorium, Cleveland, O., Jan. 26 to 29.

Ninth annual Governor's Industrial Safety Conference, Biltmore Hotel, Los Angeles, Calif., Feb. 5 and 6.

AIME annual meeting (San Francisco), St. Francis, Sheraton Palace and Sir Francis Drake Hotels, San Francisco, Calif., Feb. 15 to 19.

Twenty-first American Power Conference, Illinois Institute of Technology, Hotel Sherman, Chicago, Ill., March 31 to April 2.

International Symposium, Physical Chemistry of Extractive Metallurgy, Pittsburgh, Pa., April 27, 1959.

As We Went to Press . . .

Market developments in September came thick and fast on top of August's doldrums. The President applied lead-zinc import quotas; the Russians upset the tin market; and claims were made that the Russians were responsible for the drop in aluminum prices.

● Canadian experts estimate the loss of zinc sales to the U.S. over 1957 sales at 44,000 tons worth $8.8-million; but compared to the 1953-to-1957 base of the quotas, the loss will be 60,000 tons.

For lead, Canadian losses are expected to be somewhat smaller—about 10,000 tons. Australians termed the President's action as "ruthless"; the British called it a "melancholy retreat"; Canadians said it was "deplorable and untimely"; and Mining Congress spokesmen called it "inadequate." For details see Washington Impact (p 20) and Markets (p 22).

● Malaya, producer of 35% of the Free World's tin, has been put in dire straits by the Russian dumping, says Dr. Ismail Bin Dato' Abdul Rahman, Malayan ambassador to the U.S. Starting with small amounts in 1956, Russia was shipping at an 18,000 ton rate in midsummer. When the International Tin Agreement put on quotas, Malaya was limited to 35,000 annual tons (against 60,000 production in 1957), and as a result 283 tin mines were closed. And more will follow if the present market situation continues, according to the ambassador. See Markets (p 22), Washington Impact (p 20) and "Bolivia" (This Month in Mining, p 134).

● During the past 18 months a new factor has appeared in the primary aluminum market—Russian metal, declared Nathanael V. Davis, president, Aluminium Ltd. (which provides 95% of U.S. primary metal imports). Although the amounts were small, the market effect was disrupting, he added, and while he saw the rise of protectionists in U.S. and Europe, Mr. Davis thought that aluminum still has a bright Free World future. See Markets (p 22).

Australia's Mary Kathleen uranium mine is into production, according to Rio Tinto, which means that the mill, near the mine, will be onstream months ahead of schedule at 500 tons a year production.

"It may be fanciful, but certainly it is not fantastic to visualize submarine cargo ships on the world's oceans in 10, or more conservatively, 20 years," said Alvin Hamilton, minister of northern affairs, Ottawa, to 325 delegates to the Northern Development Conference at Edmonton, Alberta. In Britain, submarine tankers and ore carriers are on the drawing boards, specifically contemplated as carriers for Hudson Bay Iron ore. See This Month in Mining, p 134.

Economic performance of integrated steel plants using the Strategic-Udy direct reduction process will be guaranteed by Strategic Materials and Koppers Co. Willingness to make guarantees stems from results obtained in recent pilot plant studies at Niagara Falls (see "Electrons & Ions," April 1958 *E&MJ* and Mid-June Mining Guidebook for details and flowsheets). Studies show that semi-steel can be produced in prototype electric furnaces at only 1200 kwh per ton metal. And the Udys say that cost will come down to 1,000 kwh in a full scale plant. Process projections on a 600 tpd facility are available from the companies.

WASHINGTON IMPACT

Highlights

HIGHWIRE POLICY DANCE—Washington officials charged with making Government metal-mineral policy tried to maintain a delicate balance between domestic and foreign political and economic pressures. It was a dizzying act, which closed with the President reluctantly imposing temporary tariffs on lead-zinc imports.

Lead-zinc market problems posed the biggest dilemma. In early September the Administration let it be known that the White House had about accepted part of the long-pending recommendations of the tariff commission for tougher imports restrictions on the two metals, their ores and concentrates, in the form of quotas, higher duties or both.

But there was more to this "news leak" than appeared on the face of it. Temporary restrictions did not mean that the Administration has switched its basic opposition to high tariffs and quotas. Officials explained the seeming contradiction this way: State, Commerce and Interior Department delegates to the London lead-zinc conference would continue to push for White House approval of emergency production and export quotas on an international basis, pending a long-term market study by the United Nations commodity commission. These measures fared well at London. Canada, however, dragged its heels. As a major producer and exporter of the two base metals, Ottawa let it be known it would not be in any hurry to accept the international approach.

Therefore, even the mere consideration of temporary import curbs in Washington—let alone their adoption—was designed to build a diplomatic fire under Canada. Most officials in Washington still had high hopes for the long-run acceptance of the London conference suggestions. Meanwhile, President Eisenhower's domestic political advisers simply told him he couldn't wait for Canada to fall in line and to reassure domestic producers he would "do something" to alleviate their troubles. After the results of the Maine election sank in, GOP strategists took a new look at the Western vote with the election only weeks away.

On September 22, the President imposed import quotas at 80% of the 1953 to 1957 level, saying that he had acted due to the genuine distress of the domestic industry. Stocks fell in Melbourne; morale in Peru; and there were immediate violent protests in Canada and Mexico. Mining Congress spokesmen termed the President's action "weak".

A TINY TUNE—The day after Washington pulled its lead-zinc plot and before the President acted, the International Tin Agreement quit supporting tin. Although there's no domestic political oomph to tin, the ITA's troubles cast a shadow over the whole idea of international commodity agreements. Official reaction to the tin council's virtual bankruptcy was mixed. Unquestionably there will be new pressures on the U.S. to join the council. But there are other ways Washington could help bail out in-producing nations in Asia and Latin America. The most obvious, and probably the most likely, is stepped-up foreign aid to Bolivia, Indonesia and Malaya. Another is U.S. support for World Bank and International Monetary Fund loans to these countries.

Government economists aren't as worried about tin as they are about lead and zinc, however. For one thing, tin demand has been increasing. If the tin council can keep member-nations' export quotas at present levels of 20,000 tons per quarter, some experts reason, supply can be kept below demand, and prices kept steady. There's a question, too, that ITA's 91c support price may be too high. The original council price was 80c, a level below which tin prices are not expected to fall. And lower prices may stimulate all-important U.S. demand.

HARMONY AND DISCORD—Despite domestic political discord over lead-zinc, and despite the tin crisis, the Administration will continue to push for international cooperation in solving commodity problems. Where it has had to get out of step with this basic approach—as in the case of temporary lead-zinc import restrictions—it will attempt to smooth over international feelings through more foreign aid and bigger international financial programs. An example: the lead-zinc and tin situations mean Washington will step up its barter program as soon as it can solve the knotty legal problem caused by an ambiguous new crop disposal law (*E&MJ*, September 1958, p 19).

Bureau of Mines Assays Alaska's Minerals

SOUTHEASTERN ALASKA has "an abundance and variety of untapped mineral resources," the U.S. Bureau of Mines reported last month after an extensive mining and market survey of the newest state.

Minerals production ranks third in the area, behind fishing and timber industries, and there are some serious drawbacks to the economic development of indicated minerals reserves. For one thing, the new state government is likely to tax minerals mining heavily, simply because it is a dominant industry.

All this notwithstanding, says the Bureau, "interest in Alaska's minerals is rapidly reviving." Already some $250-million worth of metals has been mined in the Southeast, even though production has been at low ebb for over a decade because of the exhaustion of early bonanzas and a drop in gold purchasing power, according to the agency.

"The rebirth of interest," says the report, "is credited to development of the helicopter and improved prospecting methods." Principal products of the area have been gold, silver, copper, lead and zinc. Those to come in the Bureau's estimate range from antimony to uranium, and include barite, gypsum, limestone and garnet.

U.S. Stockpile Rapidly Nearing Completion

THE OFFICE OF CIVIL and Defense Mobilization (OCDM) has confirmed what has been general knowledge in the metals trades for months: U.S. strategic stockpiles are virtually filled, and Government buying is nearing an end.

The policy statement came in the form of "shopping instructions" which agency periodically issues to General Services Administration, its buying agency. The latest shopping list includes only three items—amosite asbestos, small diamond dies, and muscovite block and film mica.

This means most of the other 75 strategic items eligible for Government stockpiling programs since the Korean conflict have now been acquired in sufficient quantities to provide military and defense needs with a three-year supply. The three-year goal was recently set as the maximum limit, although previously OCDM also had five-year goals in addition to the shorter supply programs. Many of the items now on hand are at or near the five-year levels.

In addition to the three products which GSA will continue to buy for the three-year stockpile, eight others are still short of their three-year supply levels—bauxite, chromium, fluorspar, jeweled bearings, chemical grade manganese, palladium, selenium, and silicon carbide. These items will continue to be acquired through barter of domestic crop surpluses overseas (see below), or transfers from other U.S. Government inventories.

The policy statement does not mean that any orders already placed will be cancelled. The OCDM is still taking aluminum and nickel under the so-called "put" clauses in incentive purchase contracts, and such items as fluorspar, manganese, mica, mercury and tungsten under old incentive purchase programs which have not yet expired. These programs run out at various dates between December 31, 1958 and December 31, 1959. An extension of the fluorspar-tungsten program to the end of 1959 was vetoed by the President in the closing days of the past Congressional session, but the program for beryl was extended through June 30, 1962.

All of the 1959 fiscal appropriations earmarked for stockpiling will be used to let contracts for the upgrading of the following materials now on hand: oxygen-free copper, ferro-molybdenum, ferro-vanadium, molybdic oxide, and tungsten carbide powder. This will total $3-million. Carry-over funds from previous appropriations will be used to wind up Government purchase programs over the next 15 months.

The statement, issued by director Leo Hoegh, marks the end of an era in Washington domestic minerals policy. From now on, under the eye of the President's special stockpiling advisory committee headed by Chicago banker, Holman Pettibone, stockpiling will be aimed at the procurement and storage of more soft goods and medical supplies.

The OCDM even reflects the emphasis of the new policy in its name—changed just last month to Office of Civil and Defense Mobilization.

Rock-Busting Atoms Gain Industry Support

USE OF ATOMIC explosives as a mining tool is getting increasing Government attention. Using A-bombs to break up ore or petroleum formations has been recognized as a possibility since the underground test shot in Nevada a year ago. Atomic Energy Commission has established "Project Plowshare" to explore such prospects.

So far, most of the attention has gone to the petroleum possibilities. Several oil companies have been in contact with AEC, and the commission has been checking signals with the Bureau of Mines. The companies would like to see an A-bomb set off in the Government's huge Rocky Mountain shale reserves as a test.

However, the bomb should have mining applications, too—such as breaking up low grade ore deposits to permit leaching. AEC is eager to hear from interested companies. One mining company already has come forward with a proposal.

The half-dozen underground weapons shots scheduled in Nevada this fall, together with the special Plowshare test slated for New Mexico next Summer, will provide more information.

Labor This Month

BIG STEEL LABOR CLUES 1958 DEMANDS—The first signs of what employers can expect in union negotiations next year come from the giant Steelworkers union—sure pacesetters for the new wage round. Union president David J. McDonald promises a hefty set of demands in wages and fringe benefits. And, what goes in big steel negotiations will also go in other important bargaining such as the nonferrous mining industry. Like the Steelworkers, the Mine-Mill Smelter Workers union three-year contracts run out in mid-1959. If McDonald racks up a settlement anywhere near his demands, it will be a costly bargaining year.

THE OUTLOOK IS TROUBLE—Months before the steelworkers settle down to forming final demands, USW chief McDonald talks strike. He advised cheering steel union convention delegates they can expect a "big strike" if the industry doesn't take to the union demands. Normally, this could be set down as just pre-bargaining strategy, but the United Steelworkers union is a paradox—there's no sure way of knowing what's going to happen. In any case, the preliminary targets spelled out for the next bargaining round are:

A big wage increase; a shorter work week; better pensions and higher unemployment benefits; higher premium pay for weekend work; longer vacations and protection against automation. While this is a preliminary package that includes everything but a coffee break, it does put the union on record. And the program clashes head-on with what the steel industry talks about for 1959. Say the Steelmen: no wage increase that will add to inflation. It's no secret the industry thinks it overpaid this year through automatic pay hikes and cost-of-living increases during a good-sized recession in steel most of the year.

THE SECRET TO NEW BARGAINING—McDONALD—What happens to the Steelworkers president in the months ahead may be the key to the new round of bargaining. Certainly, the way USW goes, Mine-Mill and others follow close behind. But the big questionmark is McDonald, himself. For almost a year, his leadership has been threatened inside the union. He virtually blotted it out at the recent USW convention. Should he feel it necessary to display his new authority, it could show up at the negotiating table. There's little doubt that McDonald would like to score well after three quiet years—and this may be the time to do it. If so, look for real trouble. There's another more practical matter; the steel industry recession is clearing up, but slowly. It will still be climbing out of 1958 troubles in the new wage round and would hope to recoup some losses to the union. This has the makings—with all these ingredients—of a real fight.

TIP-OFF IN AUTO LABOR DEAL—The recent settlements between the Ford Motor Co. and Walter Reuther's United Auto Workers won't help McDonald's position in 1959. The auto contract gains were modest compared with the steel union's preliminary goals. This won't be forgotten by the industry—even if times are much improved by mid-year. Reuther's willingness to take a comparatively light package for three years will run into the steel bargaining. The UAW gets 10c for 1959—just two-thirds of steel's contract over the past three years.

MINE-MILL ASKS NEW ANTI-RECESSION ROUTE—Leaders of the Mine-Mill Smelter Workers union want an alternative from the White House for the unsuccessful minerals stabilization bill. They blame the Administration for its death in Congress via lack of support. As an alternative, they push a three-point demand on President Eisenhower: (1) use funds already provided to buy defense minerals for the national stockpile (2) restrict imports of lead and zinc from low wage areas and (3) barter surplus farm products for foreign metals. Point three, says MMSW, will indirectly aid domestic producers by taking up excess foreign minerals.

Even while shooting for a new anti-recession measure, the mine union sees brighter times ahead. The trend of the big nonferrous producers to longer work schedules is one bright sign. When Kennecott moved to shift from the workweek in its mines in Utah, Nevada, Arizona and New Mexico from five to six days, it meant adding 750 shift workers.

MARKETS

Lead, Zinc and Smelter Copper Prices Up. U.S. Imposes Quotas

THE E&MJ INDEX OF NON-FERROUS METAL prices in September dropped to 168.29% of the 1922-'24 average, from 168.36. The fall in tin prices was largely responsible.

Sales of copper in the U.S. in September were the highest of the year according to pricings reported to *E&MJ*. Pricings reported outside the U.S. were unchanged from July and better than in August.

Copper Institute figures for August show world stocks of refined copper down 38,632 short tons to 436,532 tons. World deliveries to fabricators rose to 247,060 tons in August—this is the highest since January 1958 and is above the annual average for any year. Shipments of refined copper to the U.S. Government were 10,208 tons; they have been at about this level for the past three months. Shipments of copper to fabricators abroad in August were the highest on record.

Prices of copper in the U.S. were rather stable in September. Producers held to the 26½c price delivered. Custom smelters had dropped to 26c August 28, but most of their business after Sept. 18 was again at the 26½c price. October 2 they raised to 27c. London began the month at £203 prompt bid, about 25.4c, and the first day of October it was up to £213, about 26.6c. Though many producers were delivering on the prompt price, or the prompt settlement price which is about 0.05c higher, spot copper was worth about 1¼c more in Europe. At prices above 27½c in Europe there was some flow from the U.S. Usually the flow is the reverse. Katanga raised to 27.225c Sept. 23.

Analysts in the U. S. felt this situation was not likely to continue. Normally the U.S. is a net importer of copper and only the high stocks in the U.S. permit this situation. If the price relationship between the U.S. and Europe continues and the recession in the U.S. does not reassert itself, production in the U.S. must increase by more than the amounts Kennecott and Phelps Dodge have announced. Many observers believe this price relationship gives the U.S. producers the opportunity to raise prices. Owing to the U.S. import duty of 1.7c many believe U.S. prices will need to be from 1.5c to 2.5c above Europe.

Strikes against all Rhodesian copper companies started in the middle of September. Mining, smelting and refining were stopped. Since work matters rather than wages is the basic issue, many observers believe it may continue for a long time. About 38,000 tons of copper per month are being lost.

International Nickel's Canadian properties were struck Sept. 24. Mines, smelters and refinery are down. About 9,000 tons of copper, as well as nickel and platinum, are being "lost". October 1 clerical workers at Kennecott's Chino operation struck. Production workers were honoring the picket lines. A planned strike in Mexico at all metal mines and smelters, and some fabricating operations, including steel, was postponed until late October.

UN-sponsored meetings in London attended by representatives of about 35 UN countries decided not to take any action in connection with the copper industries. COCOM (Coordinating Committee of NATO) decided to remove restrictions on the export of many products to the Iron Curtain countries, including copper shapes.

Aluminum industry growth is endangered by increasing protectionist sentiment in the U.S. and Europe, Nathanael V. Davis, president of Aluminium Ltd. told the Executive Club of Chicago. He said if sizable exports of aluminum by Russia demonstrate it is using them in economic warfare all Free World governments should take suitable measures. He added, *"If, however, the appearance of Russian exports (of aluminum) is used as a pretext for protectionism applied against friendly nations, the Soviet Union will have achieved a notable victory in the cold war."* Some U.S. primary aluminum producers have been saying recently exports of USSR aluminum are motivated by economic warfare considerations and that they are a threat to the Free World. They have, however, been calling for import quotas and higher import duties against all foreign aluminum (see *E&MJ Metal & Mineral Markets*, July 10 and July 17, p 1). Early this year officials of the primary companies in the U.S. indicated Russia had either designed away from aluminum in aircraft (as had the U.S.) or had cut aircraft output drastically and increased missile production, resulting in a surplus of aluminum too great to channel into other industries. Davis suggested no USSR aluminum is coming into the U.S. and that only about 1% of the Free World's consumption is of Russian aluminum.

U.S. primary aluminum producers have been vigorously seeking all kinds of Government aid. The need for such aid may be greater next year than in 1958. People in the industry know it has greatly overexpanded. In the past few years the U.S. Government has taken into the stockpile heavy tonnages at the request of the producing companies in connection with "put" contracts (about 300,000 tons in 1958 and more in 1957), yet recently the industry was down to about 70% of capacity. There is some indication of a slight improvement in consumer demand and there have been announcements of reopening of some plants. But the more outspoken in the industry doubt it will be sufficient to 1) absorb the heavy stocks held by the fabricating branches of the primary producers—these stocks are not included in the official Bureau of Mines statistics because only those still in the accounts of the reduction plants are listed as stocks, 2) offset the drop in 1959 in "puts" to the Government of 250,000 or 300,000 tons and 3) absorb output from the new capacity not yet in production, or full production.

Lead was raised to 12c a lb by a leading custom smelter Oct. 2; others followed. It had taken the lead in raising to 11c Sept. 17 and to 11½c Sept. 30. Smelters early in the year had taken in lead ore at prices too high to permit sale at a profit at the lower prices. The considerable increase in sales and the probable diminution of competing sales of foreign material in the U.S. made the price rise practical. The (probably temporary) embargo by Mexico on all exports of lead and zinc to the U.S. and abroad may also have been a factor.

The Administration surprised even its own mineral officials by imposing import quotas on lead and zinc effective Oct. 1. Though they permit imports of 80% of the 1953-57 average, compared with the first half of 1958 lead is cut back by 44% and zinc 25% (see *E&MJ Metal and Mineral Markets*, Sept. 25, for details). The decision, Washington officials say (but not for quotation), was a direct result of the apparent strength shown by the Democrats—they suggest the Administration needs the support of Western mining groups.

Zinc was raised to 10½c Oct. 2 by a leading custom smelter. Zinc sales reported to *E&MJ* (which are used to calculate weighted average prices) for each of the last two weeks of September were as great as many months of 1958; September sales were 2½ times as high as several months of this year.

Prime Minister Menzies of Australia read a letter to Parliament from President Eisenhower in which the President indicated if multilateral plans, such as metal production cuts and export reductions, were arranged by producing countries, the U.S. import quotas might be removed.

Tin prices dropped Sept. 18 in London by about £90, more than 11c, when the Tin Council failed to buy. Most believe it ran out of funds. The price recovered most of the loss. Some feel the Tin Council has found it less expensive to support Singapore prices.

Average Prices September *(E&MJ Quotations)*

Copper:

Electrolytic, domestic refinery	26.081
Electrolytic, export refinery	25.489
Lead:	
Common, New York	10.872
Common, St. Louis	10.672
Silver and sterling exchange:	
Silver, New York, per oz.	88.673
Silver, London, pence per oz.	75.881
Sterling Exchange	280.328
Zinc:	
Prime, Western, East St. Louis	10.000
Prime, Western, delivered (g)	10.500
Tin:	
New York Straits	93.975
Gold per oz. U. S. price	$35.000
Quicksilver, per flask	$238.200
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$59.720
Cadmium (a)	152.600
Cadmium (b)	152.600
Cadmium (c)	152.600
Aluminum, 99% plus ingot	26.800
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(f) Contract price, f.o.b. Port Colborne U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

International dealings rose 9½% in volume. Bar gold rose fractionally; coins gained 3½% in some South American centers, but less in Western Europe. London led and Paris dropped in dealings. Most Asiatic markets were active, especially Djakarta. Bombay showed a decline. No Russian gold sales were reported. Some new gold was bought by American residents. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Aug. 31	Sept. 30	Aug. 31	Sept. 30
NEW YORK, transit	.....	.....	$35.08⅛	$35.08⅛
MANILA	$42.00	$42.25	35.80	35.85
HONG KONG	46.85	45.50	38.45	38.25
BOMBAY	57.60	56.75	56.00	55.50
TANGIER	40.40	40.10	35.20	35.20
BEIRUT	42.35	41.75	35.24	35.24
PARIS	41.15	41.00	36.15	36.30
BUENOS AIRES	39.45	40.20	35.40	36.60

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of September reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered Consumers' plant	26.125 lb
F.o.b. refinery	25.725 lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Sept. 1958	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1	Holiday	24.550	Holiday					
2	26.050	25.125	10.750	10.550	10.500	10.000	24.700	95.750
3	26.000	25.050	10.750	10.550	10.500	10.000	24.700	95.125
4	25.975	25.150	10.750	10.550	10.500	10.000	24.700	94.750
5	26.075	25.275	10.750	10.550	10.500	10.000	24.700	94.625
6	— No Market —		10.750	10.550	10.500	10.000	24.700	94.625
8	26.100	25.100	10.750	10.550	10.500	10.000	24.700	94.625
9	26.075	25.125	10.750	10.550	10.500	10.000	24.700	94.250
10	26.100	25.250	10.750	10.550	10.500	10.000	24.700	94.500
11	26.075	25.350	10.750	10.550	10.500	10.000	24.700	95.250
12	26.100	25.400	10.750	10.550	10.500	10.000	24.700	95.500
13	— No Market —		10.750	10.550	10.500	10.000	24.700	95.500
15	26.075	25.300	10.750	10.550	10.500	10.000	24.700	95.625
16	26.075	25.700	10.750	10.550	10.500	10.000	24.700	95.500
17	26.100	25.600	10.750	10.550	10.500	10.000	24.700	95.375
18	26.100	25.850	11.000	10.800	10.500	10.000	24.700	86.500
19	26.100	25.850	11.000	10.800	10.500	10.000	24.700	90.500
20	— No Market —		11.000	10.800	10.500	10.000	24.700	90.500
22	26.100	25.800	11.000	10.800	10.500	10.000	24.700	92.500
23	26.100	25.775	11.000	10.800	10.500	10.000	24.700	93.375
24	26.100	25.850	11.000	10.800	10.500	10.000	24.700	92.750
25	26.100	25.925	11.000	10.800	10.500	10.000	24.700	94.750
26	26.100	26.050	11.000	10.800	10.500	10.000	24.700	94.375
27	— No Market —		11.000	10.800	10.500	10.000	24.700	94.375
29	26.100	25.875	11.000	10.800	10.500	10.000	24.700	94.375
30	26.100	25.800	11.312	11.112	10.500	10.000	24.700	94.625
AVERAGES FOR MONTH								
Sept.	26.081	25.489	10.872	10.672	10.500	10.000	24.700	93.975
AVERAGES FOR WEEK								
Sept.								
3	25.988	24.835	10.750	10.550	10.500	10.000	24.700	94.975
10	26.065	25.180	10.750	10.550	10.500	10.000	24.700	94.521
17	26.085	25.470	10.750	10.550	10.500	10.000	24.700	95.458
24	26.100	25.825	11.000	10.800	10.500	10.000	24.700	91.021
CALENDAR WEEK AVERAGES								
Sept.								
6	26.025	25.030	10.750	10.550	10.500	10.000	24.700	94.975
13	26.090	25.245	10.750	10.550	10.500	10.000	24.700	94.896
20	26.090	25.660	10.875	10.675	10.500	10.000	24.700	92.333
27	26.100	25.880	11.000	10.800	10.500	10.000	24.700	93.688

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Sept. 1958	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
1	Holiday	75.000d.	Holiday	250s. 5¾d.	Holiday
2	88.625	75.000d.	280.1562	250s. 6¼d.	$35.00
3	88.625	75.000d.	280.0750	250s. 7½d.	35.00
4	88.625	75.000d.	280.0562	250s. 7¾d.	35.00
5	88.625	75.250d.	279.8125	250s. 9d.	35.00
6	(e)	(e)	(e)	(e)	35.00
8	88.625	75.750d.	280.0625	250s. 7¾d.	35.00
9	88.625	76.000d.	280.1875	250s. 7¼d.	35.00
10	88.625	76.500d.	280.2500	250s. 6d.	35.00
11	88.625	76.125d.	280.1875	250s. 6¼d.	35.00
12	88.625	76.125d.	280.0937	250s. 6¾d.	35.00
13	(e)	(e)	(e)	(e)	35.00
15	88.625	76.125d.	280.2812	250s. 6d.	35.00
16	88.625	76.125d.	280.3125	250s. 4¾d.	35.00
17	88.625	76.125d.	280.3125	250s. 5d.	35.00
18	88.625	76.125d.	280.4500	250s. 4¾d.	35.00
19	88.625	76.125d.	280.4687	250s. 2¾d.	35.00
20	(e)	(e)	(e)	(e)	35.00
22	88.625	76.125d.	280.5625	250s. 2½d.	35.00
23	88.625	76.125d.	280.6562	250s. 2d.	35.00
24	88.625	76.125d.	280.6562	250s. 1½d.	35.00
25	88.625	76.125d.	280.5625	250s. 3¼d.	35.00
26	88.875	76.125d.	280.4687	250s. 3¾d.	35.00
27	(e)	(e)	(e)	(e)	35.00
29	88.875	76.125d.	280.6250	250s. 4d.	35.00
30	89.125	76.250d.	280.6562	250s. 3d.	35.00
AVERAGES FOR MONTH					
Sept.	88.673	75.881d.	280.328	—	35.00
AVERAGES FOR WEEK					
Sept.					
3	88.625	—	280.081	—	35.00
10	88.625	—	280.074	—	35.00
17	88.625	—	280.237	—	35.00
24	88.625	—	280.559	—	35.00

Calendar Week Averages: New York Silver: Sept. 6th, 88.625; 13th, 88.625; 20th, 88.625; 27th, 88.675.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.ob. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS *(Continued)*

London Metal Exchange Quotations

Sept.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	203	203½	203½	203¾	70⅝	71	72¼	72½	64¾	64⅞	65¼	65⅜	745	746	745	746
2	205	205⅛	205¼	205½	70⅝	71	72¼	72⅝	64½	65	65¼	65⅜	740	740½	739½	740
3	206	206¼	206¼	206⅜	71¼	71½	72¼	72½	64½	64¾	65	65¼	733	734	733	734
4	206¼	206½	206½	206¾	71⅞	72	72⅞	73	64½	64¾	65	65¼	730	730½	731	731½
5	206¼	206⅜	206½	207	71½	71¾	72⅛	72¼	63¾	64	64½	64⅝	730	730½	726½	727
8	206¼	206⅜	206½	206¾	70⅞	71⅜	72⅛	72¼	64⅝	64½	64⅝	65	730	730½	726½	727
9	206¾	207	206¾	207	70⅝	71	72⅛	72¼	64⅜	65	65¼	65¼	730	730½	725½	726½
10	207	207¼	207	207¼	70⅝	71	72	72½	64⅜	65¼	65¼	65⅜	730	730½	727½	728
11	206½	206¾	206½	206¾	70¼	70⅜	71⅞	71⅞	65⅛	65½	65⅜	65⅝	730	730½	728	728½
12	207¼	207½	207¼	207½	70	70⅛	71¾	71⅞	65¼	65⅝	65⅜	65½	730	730½	729½	730
15	210	210¼	210	210¼	69¾	70	72	72¼	65	65⅛	65⅜	65½	730	730½	730	730½
16	209¾	210	209¾	210	70¾	70⅞	72⅛	72¼	65⅜	65⅝	65⅜	65⅝	730½	731	730½	731½
17	212½	212¾	213	213¼	71¾	72	73	73⅛	66	66¼	66¼	66⅜	730	730½	730	730½
18	213¼	213½	213¼	213½	70	70¼	71½	71⅝	64½	64¾	64¾	65	640	645	640	642½
19	211½	211¾	211½	211¾	70¾	71	72⅝	72⅝	65¼	65½	65½	65¾	670	672½	662½	665
22	213	213¼	213	213¼	71	71½	72¼	72½	65⅝	65½	65½	65⅝	700	705	685	690
23	211½	211¾	211¾	212	70	70½	71½	71¾	65⅜	65½	65½	65⅝	690	692½	680	682½
24	212	212¼	212	212¼	69	69¼	70	70¼	64¼	64½	64¾	64⅞	695	700	687½	690
25	212¼	212½	212¼	212½	69¼	69½	70½	70⅝	65⅛	65⅜	65⅜	65⅝	710	712½	700	702½
26	211¾	212	211¾	212	69	69¼	70⅜	70½	64⅞	65	65¼	65⅜	717½	720	711	712
29	212¼	212½	212¼	212½	69¼	69½	70½	70⅝	65	65¼	65⅜	65⅝	717½	720	707¼	710
30	211¾	212	212	212¼	70	70½	71¼	71⅜	65⅛	65⅜	66	66⅛	723	723½	713	715
Av'g's	£209.313		£209.426		£70.523		£71.855		£65.031		£65.389		£718.148		£713.852	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

September 30, 1958

Aluminum ingot, 99 plus % lb.		26.8¢
Antimony, spot, lb., less than carload, in cases		32.59¢
In bulk, carload lots, f.o.b. Laredo		29.00¢
Imported, 10 ton min. (p), 99½%		23¢
Bismuth, ton lots, lb.		$2.25
Cadmium, commercial sticks, delivered, lb.		$1.45
Calcium, lb., ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb., contract del.		$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957		$2.00
Germanium, per gram, 10,000 gram lots	(a)37¢ — (b)40.2¢	
Indium, troy oz.	$1.25 @	$2.25
Lithium, lb., 98%	$9.00 @	$11.00
Nickel, cathodes, lb. (a)		74¢
Other sales, reg. sellers		74¢
Sales by dealers, etc.		74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16		35¼¢
Palladium, troy oz.	$15.00 @	$17.00
Platinum (wholesale lots), troy oz.	$55 @	$60
Quicksilver, flask of 76 lb., 25 flasks or more	$237 @	$240
Selenium, 99 plus %, lb.—(Feb. 19, 1958)		$7.00
Silicon, minimum 97%, carloads, lb.		21½¢
Semi Conductor grade, lb.		$350
Tellurium, lb.		$1.65
Thallium, 100 lb. or more lb.		$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)		$1.82

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Oct. 1, 1958. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	(a)$28 @	(a)$35
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:		
44% Cr_2O_3 no ratio	$22 @	$23
48% Cr_2O_3 3 to 1 ratio	(a)$44 @	$46
Iron Ore, Lake Superior, Lower Lake ports, long ton:		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi, non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$134.52
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports, import duty extra, export duty included, $1.05 @ $1.10; both duties excluded, $.915 @ $.965. Long-term contract nominal.		
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines	$1.18 @	$1.23
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.05 @	$1.10
Tungsten Ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra	$7.75 @	$8.50
U. S. scheelite, f.o.b. mill	$15.50 @	(a)$22
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines		31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton.		$56

(a) Nominal. (e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered		5¼¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.52 @	$1.55
Copper Sulphate, 100 lb. eff. July 2, '58		$11.05
Germanium Oxide, gram		27½¢
Molybdic trioxide, technical, per lb. of Mo.	$1.38 @	$1.39
Imported, incl. 37¢ duty	$.75 @	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr. (4-9% C)		28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.		12¼¢
Ferromolybdenum, 58 to 64% Mo lb. of Mo contained	$1.68 @	$1.74
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957)		14.60¢
Ferrotungsten, 72 to 82%, lb. of W contained		$2.15
Ferrovanadium, per lb. of V delivered	$3.20 @	$3.40
Silicomanganese, max. 1½% carbon, lb. contracts		12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7		$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:		
Crude No. 1	$1,470 @	$1,810
Crude No. 2	$788 @	$1,155
Spinning fibers	$353 @	$593
Shingle fibers	$190 @	$220
Paper stock	$120 @	$142
Waste	$82 @	$86
Shorts	$27 @	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):		
Crude No. 1		$1,522
Spinning fibers	$494 @	$787
Shingle fibers	$142 @	$325
Asbestos, Vermont, f.o.b. Hyde Park:		
Spinning fibers	$353 @	$383
Shingle stock	$172 @	$190
Paper stock	$114 @	$145
Waste, stucco or plaster		$82
Refuse or Shorts	$39 @	$72
Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94% $BaSO_4$, per short ton	$16 @	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 @	$18
Bauxite, long ton, f.o.b. point of shipment:		
Domestic, crude, 50 to 52% (not dried) (c)	$ 5.00 @	$5.50
Domestic, chemical, 55 to 58% (c)	$ 8.00 @	$8.50
Domestic, abrasive, 80 to 84 % (c)	$18.00 @	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @	$22.50
Glass feldspar, white, 20 mesh	$10 @	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 @	$41
60% effective CaF_2	$33 @	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)		$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $30 @ $55 per ton. Scrap, $20 @ $30.		
Ocher, Georgia, ton in sacks	$26.50 @	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports		Not quoted
Sulphur, per lt. f.o.b. U. S. mines: bright		$23.50
dark		$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40 @	$31.60
For export f.o.b. vessel, lt. dep. on grade	$22 @	$24
Talc, f.o.b. works, ton:		
New York, purified	$18.00 @	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc. 100 lb.	$5.30 @	$5.50

SHHH!
he's listening
to a cable fault!

with the O-B Fault Locator

Because they're so hard to find, hidden cable faults often cause more lost production, more wasted man hours — more wasted cable, in fact — than the big faults that rupture insulation and actually destroy cable. That's why you'll find more and more mine properties today investing in O-B Cable Fault Locators, in many cases using as many as 10 Locators on a single property!

Powerful, compact (you can carry it in your pockets), rugged and virtually "tamper-proof," the O-B Locator pinpoints in a matter of minutes cable faults that would ordinarily take hours to find. The complete unit weighs only four pounds and consists of just four elements: battery and signal generator (being attached to cable end below), and headphones and slim transistor receiver. The latter, as shown above, are the only parts carried along the cable during testing! Takes only minutes to set up, tests cable up to 600 feet or longer, costs less than any cable you'll use it on! Write for complete information, or order Catalog No. 22567 to try it out for yourself.

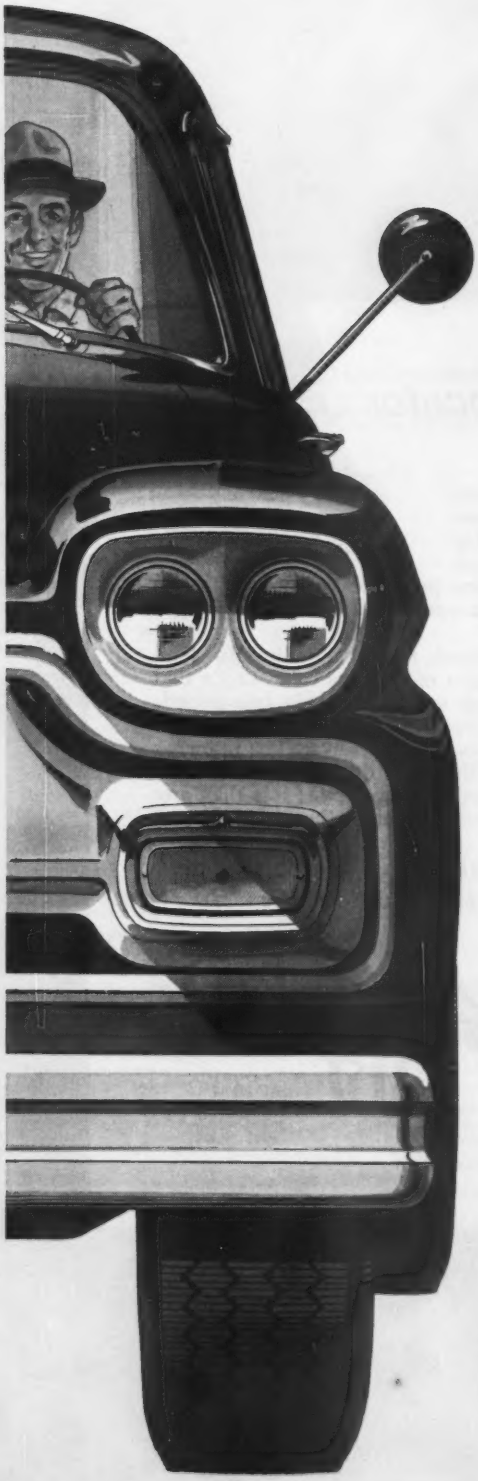
OHIO BRASS COMPANY • MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass

4828-M

NEW CHEVROLET TRUCKS FOR '59!



New Might! New Models! New Money-Saving Power!

Task-Force 59 brings you more to work and save with in every weight class—more models, thriftier engines, stronger cabs and frames, safer brakes, tougher axles and transmissions! Here's the longest, strongest line of Chevrolet trucks ever built, the best yet of the best sellers!

Good news in the light-duty class! Chevy's longer, stronger '59 line gives you a *dozen* big pickups to choose from . . . new 4-wheel drive models, newly fashioned panels, Step-Vans, and Sedan Deliveries! Scores of innovations include new hard-pulling Positraction rear axle, new bigger brakes, new stronger cabs, new broad-shouldered styling refinements!

Bright new middleweight and heavyweight might! New big-tonnage L.C.F. and conventional trucks are heftier than ever with new 5-speed transmissions, new huskier clutches, more durable rear axles in capacities as high as 18,000 lbs.! G.V.W.'s go up to 36,000 lbs. in tandems . . . and up to 21,000 lbs. in new Series 50H and 60H models with heavy-duty components!

New thriftier 6's, all-new V8 power! Chevy's best selling 6's are set to pinch pennies like never before with new camshaft design, new valve train durability! *Six* modern V8's are tougher built for bigger savings; an all-new V8, the 185-h.p. Workmaster Special* with advanced Wedge-Head design, is offered in Series 70 and 80! See 'em for yourself—the bright new trucks of Task-Force 59 at your dealer's now! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost.*

CHEVROLET

CHEVROLET TASK·FORCE 59 TRUCKS

NC-1 MINE CAR TRUCKS

7 years and 460 cars later Olga Coal Company still 100%

NATIONAL-EQUIPPED

NATIONAL CUSHIONING DEVICES

Photo: Enterprise Wheel & Car Corp.

WILLISON AUTOMATIC COUPLERS

NACO STEEL WHEELS

In 1951 Olga Coal Company bought 300 coal cars equipped with National NC-1 Trucks, National rubber cushioning devices, Willison Automatic Couplers and Naco Steel Wheels.

Based on experience with the 300 original cars, Olga Coal purchased an *additional* 120 cars. And now Olga Coal has placed a *third* order for 40 more cars. This brings Olga's modern fleet up to 460 units—*all 100% National-equipped.*

This is typical of the swing to National-equipped mine cars—for safety . . . for longer life and lower maintenance . . . for lower per-ton mining costs.

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Established 1868 *Cleveland 6, Ohio*

WILLISON AUTOMATIC COUPLERS • RUBBER CUSHIONED UNITS • NACO STEEL LINKS and SWIVEL HITCHINGS • MINE AND INDUSTRIAL CAR TRUCKS • NACO STEEL WHEELS

CANADIAN SUBSIDIARY *National Malleable and Steel Castings Company of Canada, Ltd. • 128 Simcoe St. • Toronto 1, Ontario*

AA-457B

Exclusive P&H MAGNETORQUE® and ELECTRONIC CONTROLS put this 8 yd. P&H 1800 Electric Shovel far in front for economical, daily output in open pit mining operations.

For stripping, digging, loading P&H offers power cranes and shovels

This P&H 1055-LC is designed and balanced to handle extra long booms and larger dippers. It is performing long range mining operations at Flemington, W. Va., equipped with a 48-foot boom, 34-foot dipper stick and a 3 yd. dipper.

This 2½ yd. P&H 955A is stripping overburden near Clarksburg, West Virginia. It is equipped with *exclusive* P&H MAGNETORQUE® Electric Swing which provides smoother, faster swings—without friction—without wear.

With true, tractor-type crawlers and all-welded construction, this 1½ yd. P&H 655B withstands the repeated twists, stresses and shocks of day-long mining operations. It is a popular model for fast loading and dumping.

P&H serves all these open pit mining needs

in a wide range of capacities

P&H Independent Planetary Boom Hoist contributes to the efficient operation of this 20-ton P&H 255A-TC. Boom lowering is always done under power in handling materials at this mine siding in McDowell County, West Virginia.

Electric Excavators from 3½ through 10 cu. yd.
Power Excavators from ½ through 4 cu. yd.
Truck Cranes from 10 through 70-ton capacity

HARNISCHFEGER
Construction & Mining Division
Milwaukee 46, Wisconsin

Airborne magnetometer survey plane over gold mines area near Johannesburg

WHATEVER YOUR MAPPING OR EXPLORATION NEED -- ANYWHERE IN THE WORLD -- AERO CAN SPEED YOUR PROJECT. PROFIT BY OUR BROAD EXPERIENCE.

AERO'S SERVICES: PHOTO AND TOPO MAPS, AIRBORNE MAGNETIC AND ELECTRO-MAGNETIC SURVEYS.

AERO SERVICE CORPORATION PHILADELPHIA 20, PENNSYLVANIA

Oldest Flying Corporation in the World

Offices in: DULUTH, TULSA, SALT LAKE CITY, SAN FRANCISCO, JOHANNESBURG

12" BLASTHOLES drilled CONTINUOUSLY in any rock... Here's the ONLY drill that can do it!

Joy 60-BH Drill in operation in a large Southwest copper mine.

the JOY 60-BH Super Heavyweight Champion

Here's the champion at drilling larger, lower-cost blastholes where the going is tough and high production is a *must.* The Joy 60-BH Super Heavyweight Champion has the power, the stamina . . . the sheer muscle . . . to bottom blastholes fast, shift after shift, month after month, in hard or soft formations. And it can drill out of the hole, too, when necessary. Here's why the performance of this big drill cannot be matched—it excels *in all three* of the features which determine bit penetration:

STRONGER ROTATION—Up to 14,850 ft. lbs. of torque can be applied *continuously* and safely. Accurate control of infinitely variable bit speeds and constant indication by gauge.

HIGHER BIT PRESSURE—Joy hydraulic-feed method of applying bit pressure—gripping the rod at the most logical place, near the collar of the hole—permits *continuous* pressures up to 75,000 lbs.; assures more accurate control than other methods.

MORE EFFICIENT CUTTINGS REMOVAL—Only Joy uses a heavy-duty, industrial-type, water-cooled air compressor to insure an optimum, continuous air supply.

Other features . . . rod handling device to reduce heavy rod handling and the longest derrick available to reduce or eliminate rod additions.

Only Joy has a complete line of rotary air-blast drills:

56-BH.....6¼" maximum hole diameter
58-BH.....7⅞" maximum hole diameter
59-BH.....9" maximum hole diameter
60-BH.....12" maximum hole diameter

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.
In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 251-4

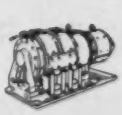
JOY

. . . EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY

Consult a Joy Engineer

WBW M7239-251

Core Drills



Slushers

Rock Bits

Drillmobiles

The "Autolimer" is made by the Shirley Machine Company, 725 Liberty Avenue, Pittsburgh 22, Pa.

New neutralizer for mine water constructed of USS Stainless Steel

Lime and acidic mine water are mixed in the stomach of the "Autolimer." Powered only by the water that flows through it, this machine dumps measured amounts of lime into the drain water to neutralize it and prevent pollution of streams.

A constant diet of lime and acid would quickly eat away most materials. That's why the major parts of the "Autolimer" are made from Stainless Steel. Stainless resists corrosion, it's hard and abrasion resistant—therefore it gives long service in the toughest mine jobs.

If corrosion and wear have damaged equipment at your mine, replace it with Stainless Steel. It cuts maintenance and it often eliminates replacements completely. Write to us for full information about Stainless Steel equipment for mine work. United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Warehouse Distributors
United States Steel Export Company

USS United States Steel

TRADEMARK

Approximate Service Limit Brand
3200°F. Castolast (Castable)
3100°F. H-W High Alumina Castable
Apache (Plastic Fire Brick)
3000°F. Chromepak (Casting Mix)
H-W Super Plastic Fire Brick
Apache G (Plastic Fire Brick with Graphite added)
2900°F. H-W Black Patch (Plastic Fire Brick)
2800°F. Harcast (Castable)
2700°F. H-W Super Castable
2600°F. H-W Lightweight Castable 2600
Harchrome (Castable)
H-W Chrome Castable
2500°F. H-W Standard Castable
H-W Periklase Castable
H-W Baffle Mix (Castable)
2400°F. H-W Extra Strength Castable
2300°F. H-W 85 Lightweight Castable
2200°F. H-W 56 Low Iron Castable
H-W 56 Lightweight Castable
1800°F. H-W 25 Lightweight Castable
1500°F. H-W Castable RC

The complete series of HARBISON-WALKER PLASTIC and CASTABLE REFRACTORIES

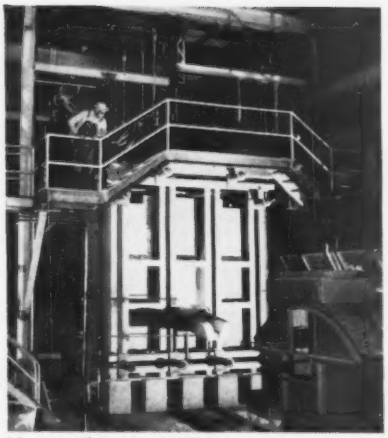
can assure the proper selection for maximum life and economy

In addition to the wide range of service temperature limits as here illustrated, these monolithic refractories possess the many different combinations of physical and chemical properties needed for best protection against widely diversified destructive factors. From these brands the best balanced selection can be made for adequately withstanding the most severe operating conditions. Some examples of the many destructive influences against which maximum resistance is needed, are: corrosion by slags, fuel ash and various other fluxes; thermal shock; disintegrating action of gases; erosion by molten metals and slags; mechanical stresses at the high working temperatures.

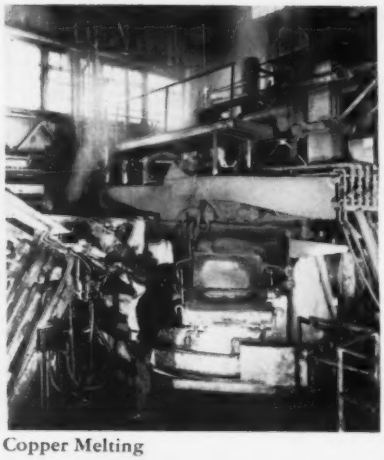
To help secure maximum service from these refractories, Harbison-Walker freely offers engineering service, recommendations based upon wide experience, and quality-controlled products.

HARBISON-WALKER REFRACTORIES CO.
AND SUBSIDIARIES GENERAL OFFICES: PITTSBURGH 22, PA.
World's Most Complete Refractories Service

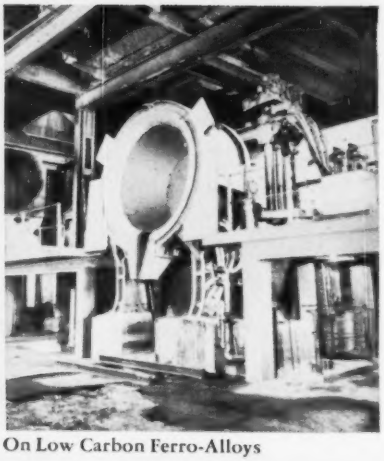
TYPICAL FURNACE APPLICATIONS: ARCHES • ASH PITS • BOILER SETTINGS • BREECHINGS • BURNER BLOCKS • BAFFLES • CATALYTIC REACTORS • DOOR LININGS • DUCTS AND PIPING • HEARTHS • INSULATION • KILNS AND CARS • LADLE LININGS • ROTARY KILN CHAIN SECTIONS • SOAKING PIT COVERS



Matte and Speiss Smelting



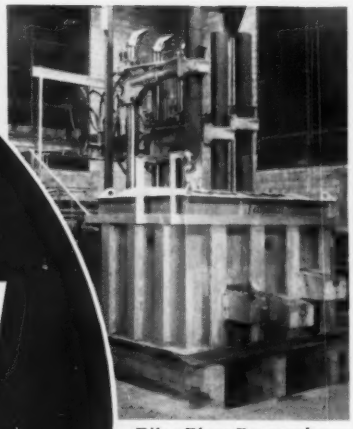
Copper Melting



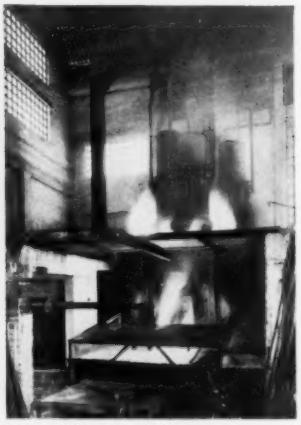
On Low Carbon Ferro-Alloys

Lectromelt* Furnaces really get around—

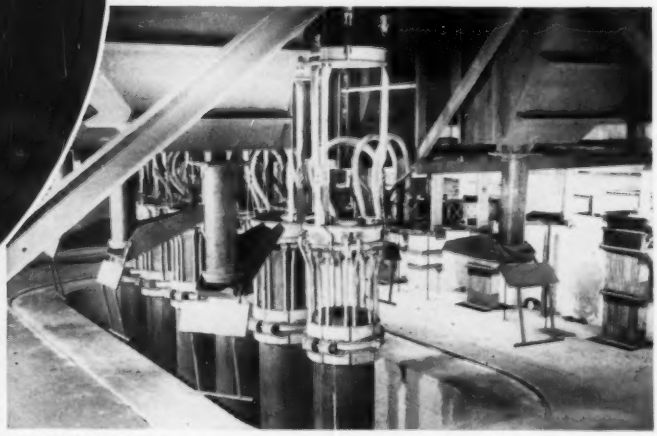
Catalog No. 105 describes furnaces for Smelting and Refining. For a copy, write Lectromelt Furnace Division, McGraw-Edison Company, 324 32nd Street, Pittsburgh 30, Pennsylvania.



Pilot Plant Research



Ferro-Alloy Smelting



"Six-in-line" Smelter

McGRAW EDISON

LECTROMELT FURNACE DIVISION

McGRAW-EDISON COMPANY

Pittsburgh 30, Pennsylvania

NEW! Thompson "Top-Tite" ROOF BOLT EXPANSION SHELLS

AVAILABLE IN
Standard and Bail types for any
⅝" or ¾" roof bolts

Patents Pending

5 ways better in any type of top

1. **MORE HOLDING POWER** in any kind of roof.
2. **TOUGH STEEL LEAVES** eliminate breakage, prevent misalignment.
3. **BETTER LOAD DISTRIBUTION** because small teeth provide *even load transfer* from leaf to hole wall. Small teeth don't crush and weaken wall.
4. **FASTER TIGHTENING** cuts bolting time. Big plug and broad leaves are designed for maximum expansion in minimum time.
5. **NO PLUG PULLOUT** at bottom because of one-piece construction. Plug can't fall out.

New "Top-Tite" shells have been thoroughly tested underground by regular bolting crews. Results prove "Top-Tite" shells are better, faster, more economical. See how they can lower your costs per ton.

Contact your distributor, or write to the factory direct.

THOMPSON Top-Tite EXPANSION SHELLS

National Mine Service Company

manufactured by
VALVE DIVISION
Thompson Products, Inc.
1455 EAST 185th STREET · CLEVELAND 10, OHIO

stocked and distributed by
NATIONAL MINE SERVICE CO.
at all branches

PLYMOUTH DIESEL

MINE-O-MOTIVE

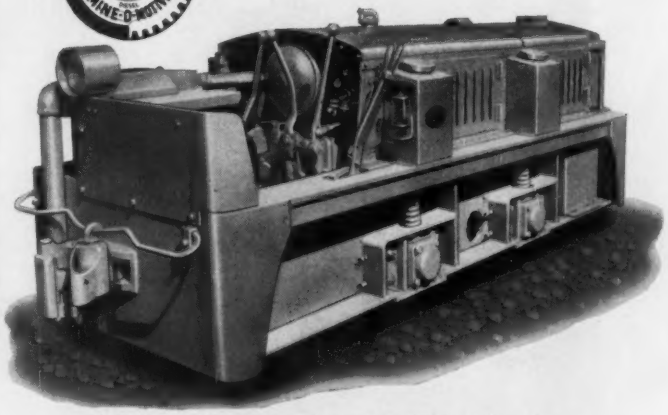
Mine Locomotives 3 to 12 Tons

Engineered expressly for

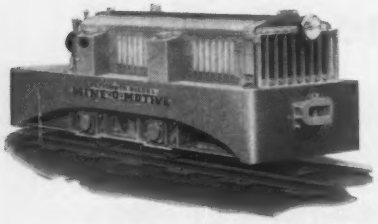
YOUR LOCOMOTIVE HAULAGE

in Today's modern mining operations

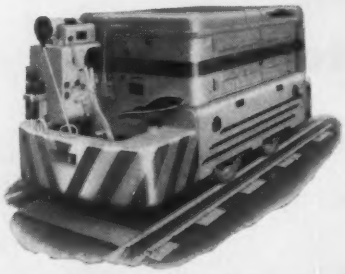
You will find these rugged locomotives performing the toughest hauling jobs in mines and tunnels everywhere. Stamina, stability—ECONOMY in performance, SAFETY in operation—and extra years of trouble-free operation—are ENGINEERED in the design and construction of the Mine-O-Motive series. Controls are convenient, simple, safe. Visibility is excellent. And the Diesel-powered models shown have the famous Torqomotive* Drive for easy starting and smooth operation. They supplement Plymouth gasoline, Diesel and Diesel-electric models which have served all industry since 1914—and with lowest ton-mile costs in the field.



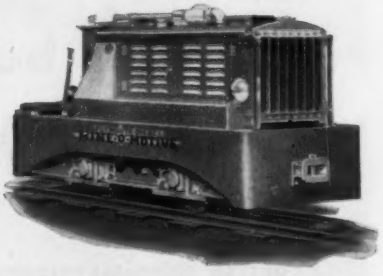
U. S. Bureau of Mines approved exhaust conditioning equipment.



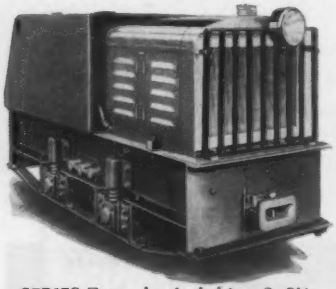
MINE-O-MOTIVE SERIES
Model FMD-00 5 or 6 Tons, Torqomotive* Drive—short wheel base, low center of gravity.



MINE-O-MOTIVE SERIES Model FMD-22 5, 6, 7, 8 or 10 Tons, Torqomotive* Drive (this model approved under Permissible Schedule #22, U. S. Bureau of Mines, for operation in gaseous mines).



MINE-O-MOTIVE SERIES
Model DMD-00, 8 to 12 Tons, with Torqomotive* Drive — low, compact, one-piece welded frame.



SERIES T, mechanical drive, 3, 3½ or 4 Tons. Torqomotive* Drive in 3½ or 4 Tons.

*TORQOMOTIVE DRIVE: Plymouth Transmission coupled to Hydraulic Torque-Converter.

FREE ANALYSIS Send us a brief outline of your hauling operations. An engineering analysis will reach you promptly with latest data on the type and size Mine-O-Motive for the best results in the work you want done.

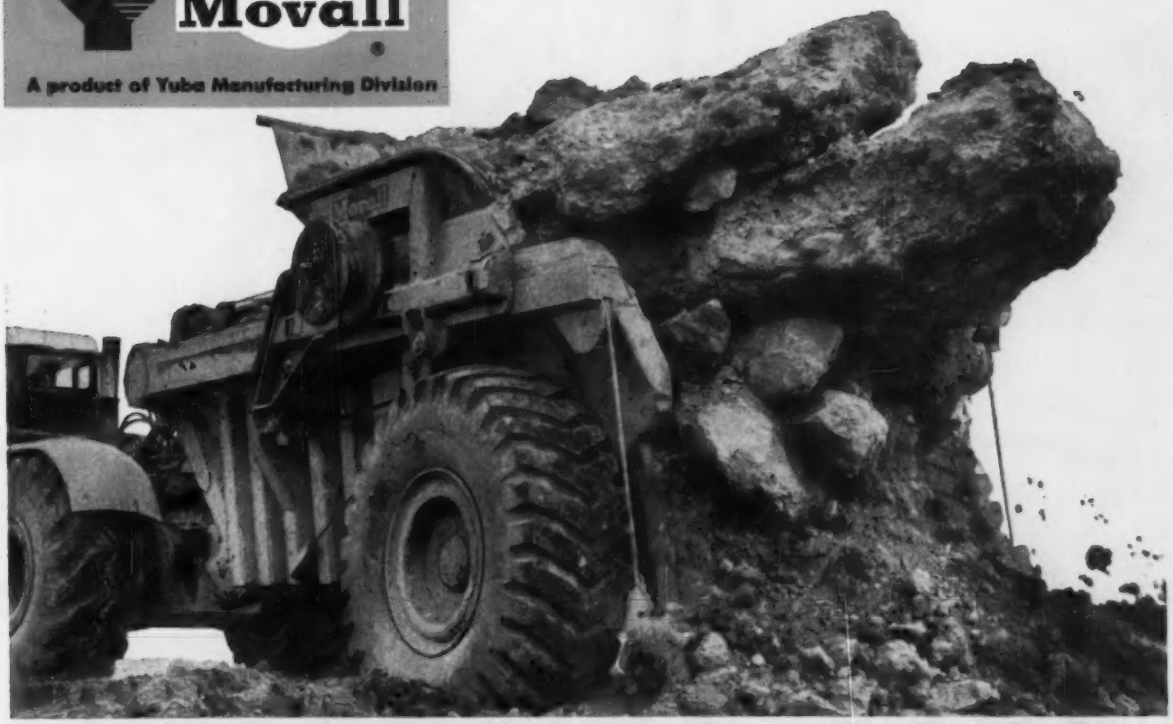
PLYMOUTH LOCOMOTIVE WORKS

Division of the Fate-Root-Heath Company,
Dept. A-22, Plymouth, Ohio

YUBA

Movall

A product of Yuba Manufacturing Division



EVERYTHING GOES!

EXCLUSIVE LEVEL-ACTION EJECTOR SAVES TIME AND MONEY

LOADED—The big target, big capacity body carries its load low, maintaining high ground clearance since frame and body are integral and compact.

TAIL GATE UP

DUMPING — Level body offers no gravity resistance, with potential 140,000 lb. ejector push assuring complete positive discharge with minimum use of power.

TAIL GATE DOWN

EMPTY — Sides and bottom are scraped clean, eliminating need for "mucking out" or decreasing capacity for next full load. Complete ejection takes only 11 to 14 seconds.

TAIL GATE DOWN

140,000 pound push cleans out desk-size rocks or sticky clay—clean as a whistle in just 14 seconds!

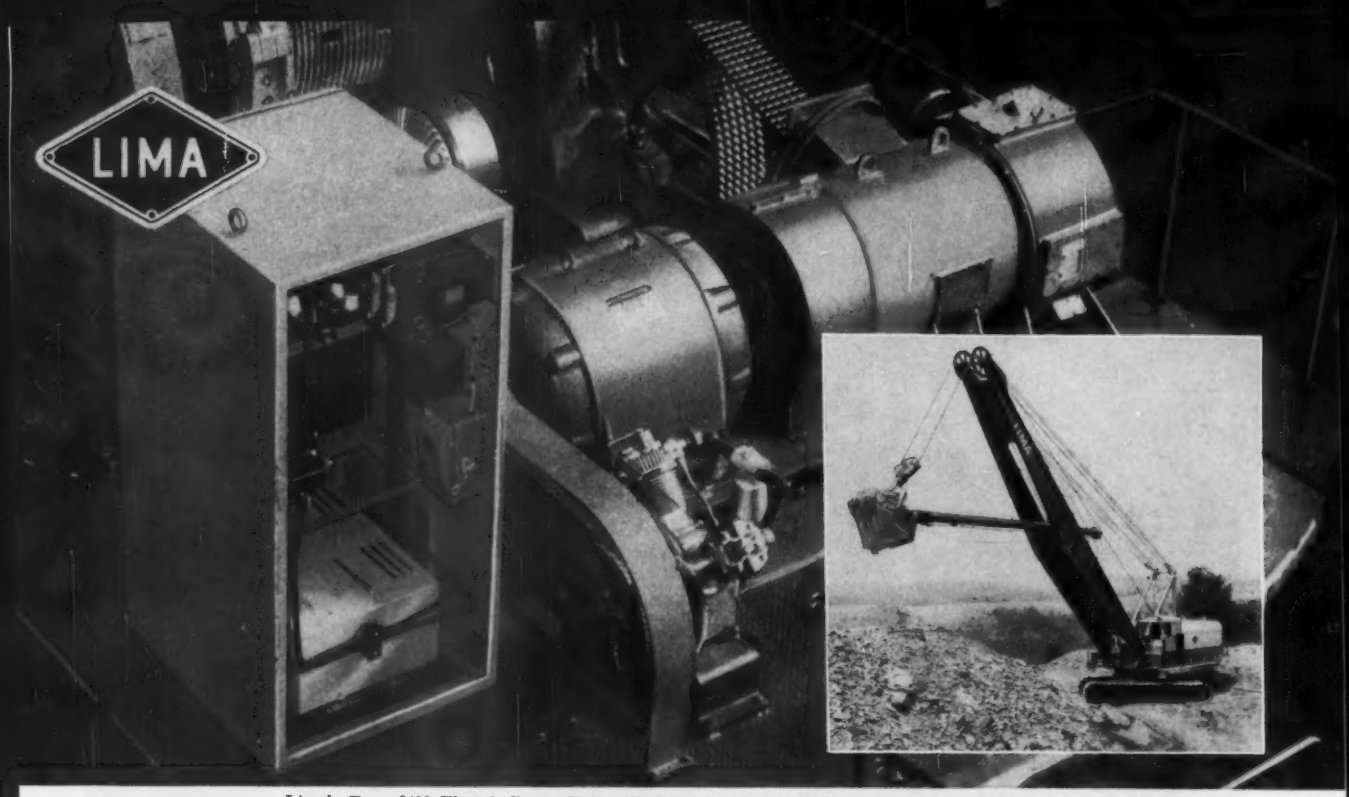
The versatile, high-speed Yuba "Movall" outperforms rear and bottom-dump haulers on most every type of off-highway job! Its powerful, positive ejector makes playthings of giant rock, frozen muck, or any other top loaded material. Bigger year 'round profits are yours with low-maintenance "Movalls" on the job. Check their unbeatable combination of features, such as high clearance, 180° turning radius, full stability in *all* operations, big tire flotation and traction, huge capacity. Get full information from your Allis-Chalmers, Caterpillar, or International Harvester Dealer, or contact *Yuba Manufacturing Division, Benicia, California,* today.

YUBA CONSOLIDATED INDUSTRIES, INC.

Plants and Sales Offices

YUBA

Yuba designs and builds a wide range of equipment for engineered construction:



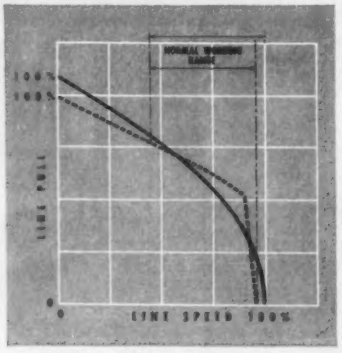
Lima's Type 2400 Electric Power Unit with AC motor and single-stage torque converter.

LIMA'S Electrical Power Unit prevents stalling, won't burn out

With Lima's optional power unit, you get power on demand through a wide operating range, and the motor will not stall or burn out under heavy load conditions. Combining an AC motor with a single-stage torque converter, it adapts actual power output to work load demand—at constant motor speed. Thus, electrically it matches diesel-torque converter performance.

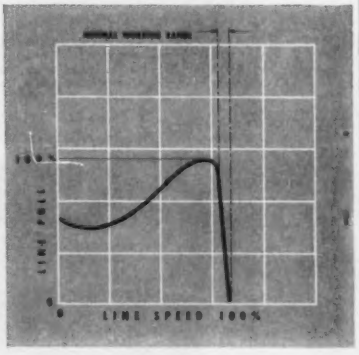
Just check the performance curves—They make it clear that LIMA's new electric power unit is the perfect answer when your job calls for electrically powered machines. Available on every Lima machine—shovels to 6 cu. yds., cranes to 110 tons.

Get the full story today from your nearby Lima distributor. Or write to Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.



Power Performance of LIMA'S Optional Electrical Power Unit.

Power performance curve of Lima's electrical power unit (solid line) compared with that of a diesel-torque converter unit (dotted line). As can be seen, the line pull will constantly increase through a long pull down in speed range, depending upon the load applied. Even under extreme loading the motor will pull down in speed only slightly and can never be stalled.



Power Performance: AC Electric motor with direct drive—

The motor speed and torque varies as shown for line speed and pull.

With a pull down in speed of only 3% to 5%, torque rises too fast. The motor will stall quickly after peak torque is reached. Workable speed range is small, stalls are frequent.

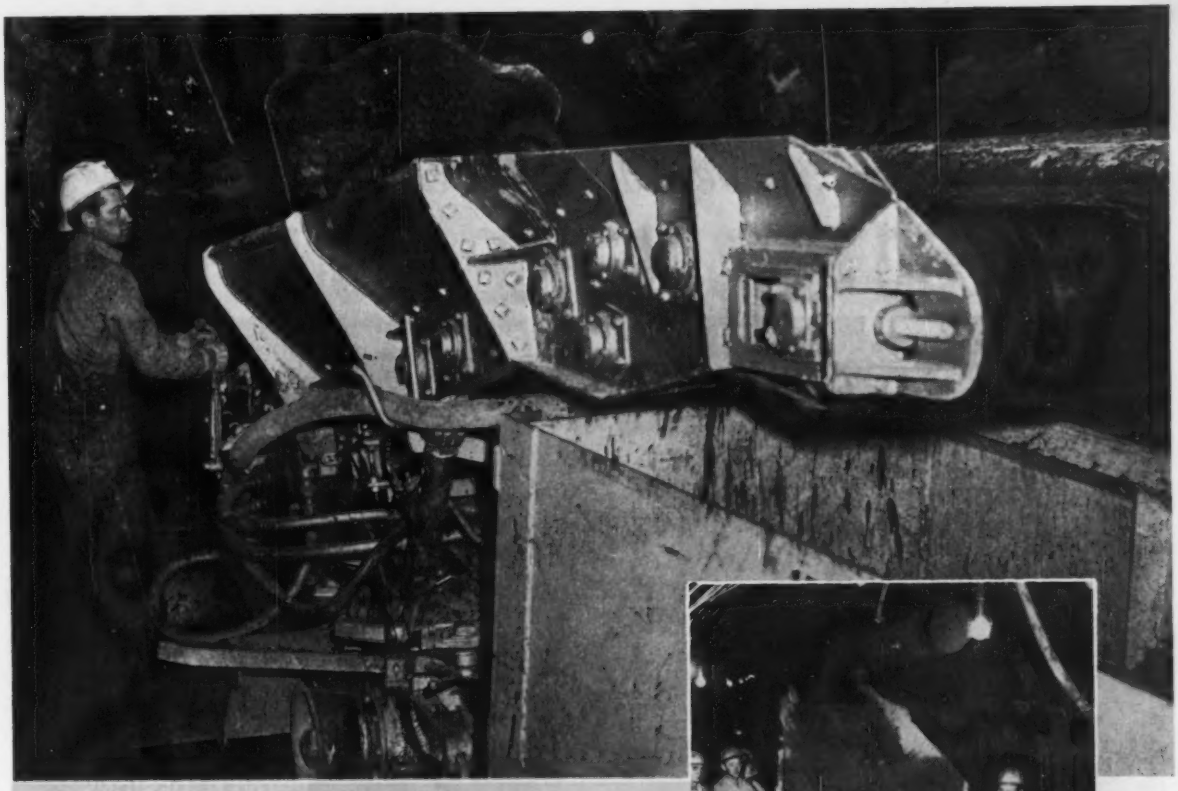
DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD

LIMA Construction Equipment Division, Lima, Ohio

BALDWIN · LIMA · HAMILTON

5827

Shovels • Cranes • Draglines • Pullshovels • Roadpackers • Crushing, Screening and Washing Equipment



Eimco Model 40H Loaders are being used in many of the high speed tunnel jobs in work today. These machines are making it possible to average high daily advance footage in all types of ground.

THE DEPENDABLE EIMCO MODEL 40H

Successful contractors, the world over, who make a profit on their job and achieve records in tunnel speed, have learned through experience that you cannot beat the Model 40H for dependable, month in and month out, high performance.

There is now available the Model 40W for headings 14 feet wide — and wider.

The experienced estimator figures his cost on the basis of using dependable, efficient, low-cost Eimcos.

THE EIMCO CORPORATION

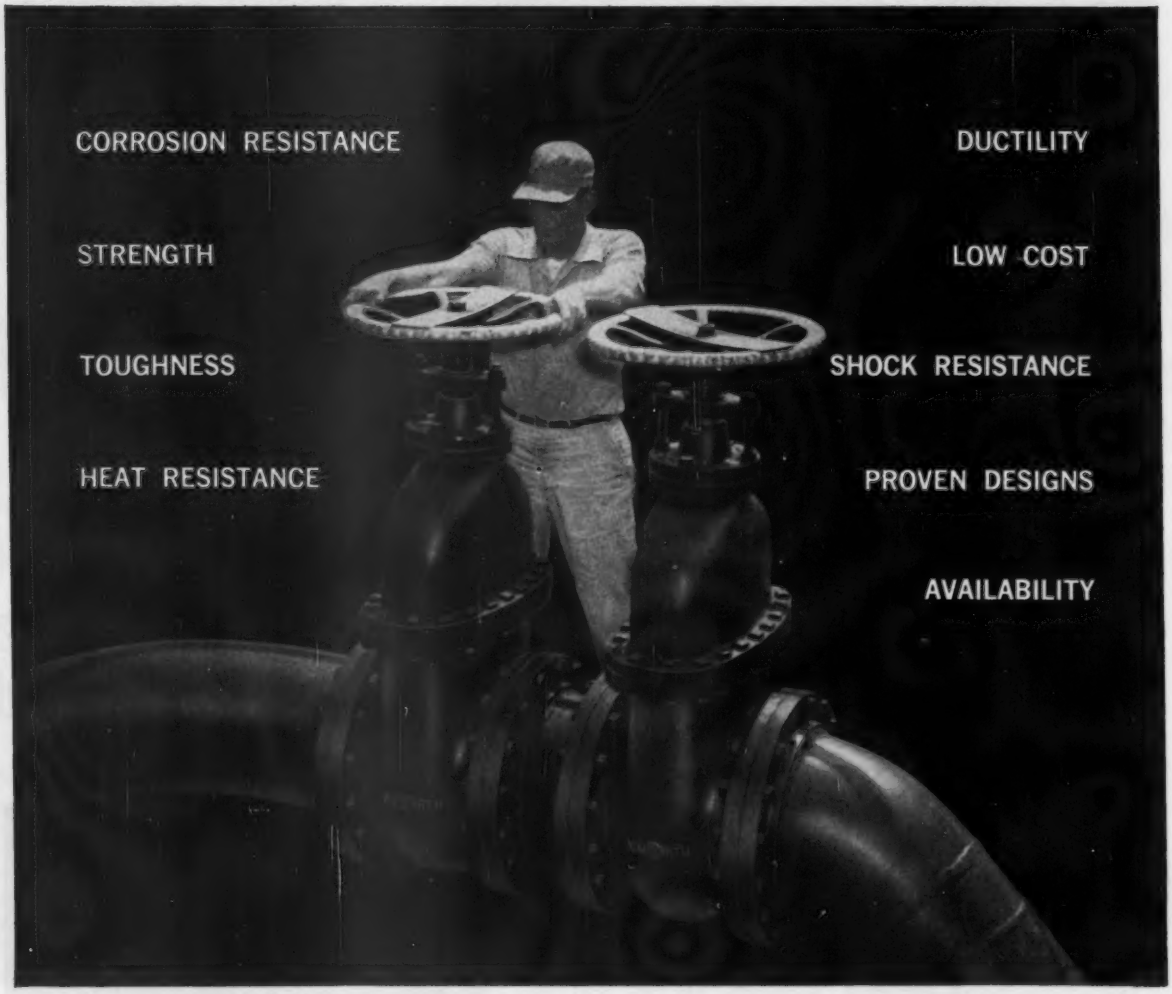
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N.Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Pittsburgh, Pa. Seattle, Wash.
Cleveland, Ohio London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B - 347

In your plant piping systems you get all these advantages with

WALWORTH DUCTILE IRON VALVES



Walworth ductile iron valves give you – at low cost – corrosion resistance comparable to gray cast iron . . . strength approaching that of carbon steel . . . long life expectancy and minimum maintenance. Proven shock resistance . . . Walworth ductile iron valves have functioned satisfactorily after being heated to 1350°F and suddenly quenched.

When you buy Walworth ductile iron valves you get the benefit of Walworth's proven engineering and designs. Sizes ½ to 24 inches, screwed or flanged ends, OS&Y and NRS types.

For your copy of the new circular on ductile iron valves, contact your local Walworth distributor, or, write Walworth direct.

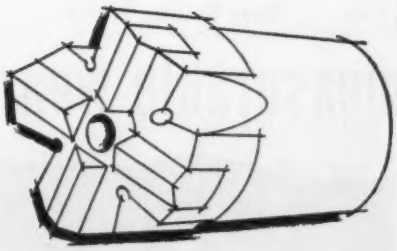
WALWORTH

750 THIRD AVENUE, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

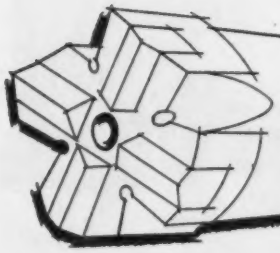
WALWORTH SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO. M&H VALVE & FITTINGS CO. • SOUTHWEST FABRICATING & WELDING CO., INC. • WALWORTH COMPANY OF CANADA, LTD.

NOW!



REMOVABILITY

AND



ONE-PIECE STRENGTH

IN AN AIR-LEG BIT!

AIR-LEG drillers, now you can have your cake and eat it, too. The new Timken® tapered socket bit is removable—yet gives you the strength of one-piece steels. The secret is the taper. It gives you all the advantages of removability with a strong, secure union.

Here are a few of the plusses you get with the Timken tapered socket but can't get with intraset steels because they're not removable.

1. You don't have to throw away the drill steel just because the carbides wear out. You do with an intraset steel.

2. You carry just a pocketfull of bits into the mine. Try putting an intraset steel in your pocket.

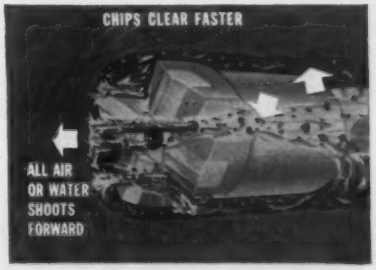
3. You can quickly change bit gage sizes using the same steel. With an intraset steel, you have to change a whole steel.

4. You don't have to lug the whole steel back to the shop to resharpen the cutting edges. You do with a 4-point intraset steel.

5. You get four carbide cutting edges. You get only two with a chisel intraset steel.

And you get further economies because the Timken tapered bit clears chips faster. The picture at right shows you how. New special-analysis carbide inserts give superior wear-resistance with added shock-resistance. And they can be reconditioned many times.

For removability *and* strength, use the air-leg bit of the future. Write for our free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



CHIPS CLEAR FASTER because 1) new five front holes shoot water or air directly against the rock face and 2) new deeper, wider wing clearance lets chips wash back faster.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

AVAILABLE NOW!

THE AIR-LEG BIT OF THE FUTURE

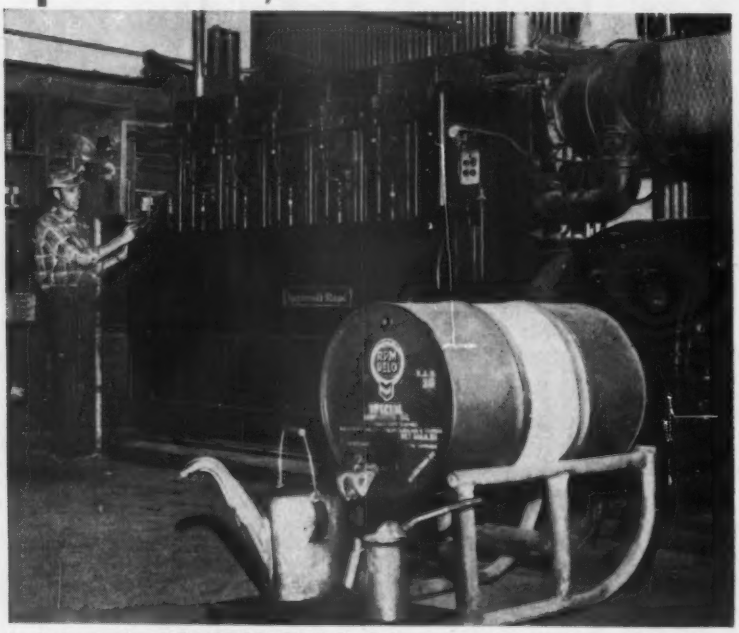
ENGINEER'S FIELD REPORT

PRODUCT RPM DELO OIL

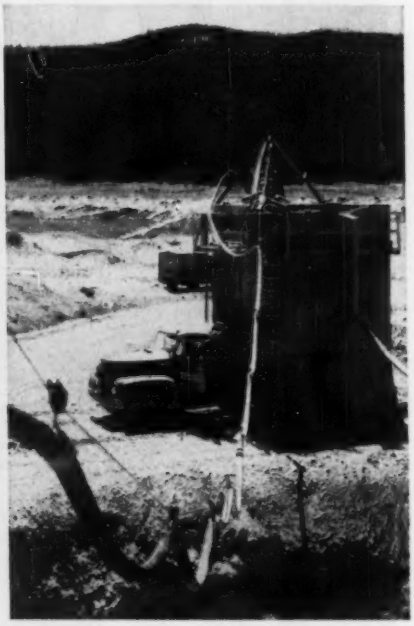
PORTER BROTHERS CORP.

FIRM Bear Valley, Idaho

Operates 7,000 hours without measurable wear



Lubricated with RPM DELO Oil, this 650-hp Ingersoll-Rand diesel is still in nearly new condition after three years' service. "We found no carbon sludge or lacquer when we tore it down last winter," says Power Plant Foreman Bill Niece (above). "And there was no measurable wear on rings, liners or bearings, though it had run more than 7,000 hours!" Engine is in power plant of Porter Brothers Corp. Firm dredges for strategic minerals under government contract.



Trucks hauling firm's ore work 'round the clock, 9½ months a year. Despite the tough punishment of carrying heavy loads over unpaved mountain roads, RPM DELO Oil keeps engines running smoothly, and eliminates excessive wear.

Giant dredge (left) processes nearly 6,000 yards of gravel every 24 hours. "Both this and our smaller dredge depend upon our diesel-generators for power," explains Superintendent Clay La Fon (right). "That's why we do everything possible to keep them running properly...and that includes using RPM DELO Oil. We've had excellent results with it in all our equipment...in our power plant, in our trucks, and in the tractors that level our tailings and restore the areas we've worked."

Why RPM DELO Oils reduce wear—prolong engine life

- Oil stays on engine parts—hot or cold, running or idle
- Anti-oxidant resists lacquer formation
- Detergent keeps parts clean
- Special compounds prevent corrosion of bearing metals
- Inhibitor resists crankcase foaming

For More Information about this or other petroleum products or the name of your nearest distributor, write or call any of the companies listed below.

LUBRICATING OILS RPM DELO

TRADEMARK "RPM DELO" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

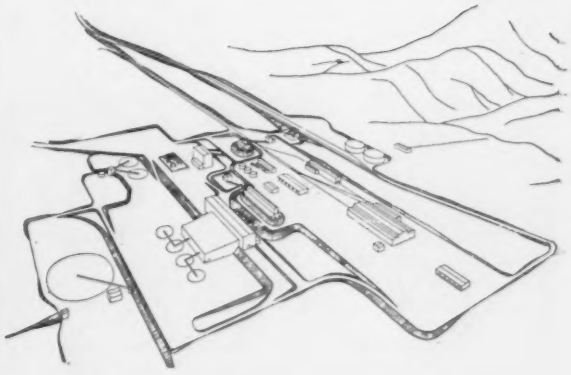
STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

E&MJ NEW PRODUCTS DIGEST

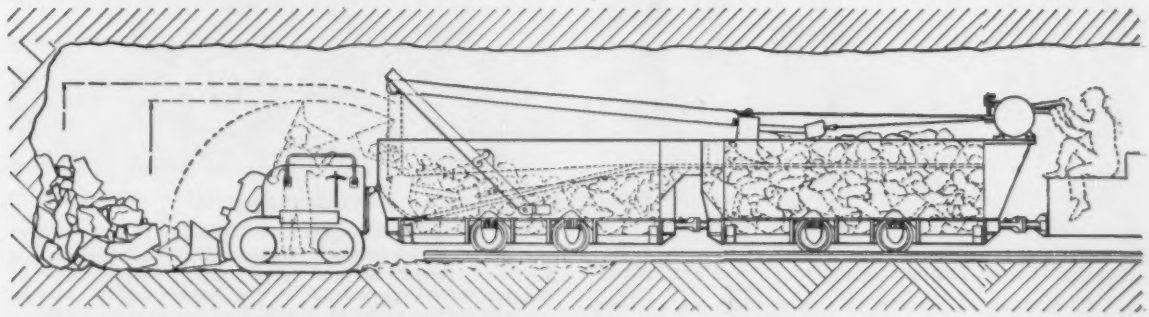
In this issue—Anaconda enters design engineering field, Joy enters mineral processing field, Buell introduces two new classifiers, and an interesting cleaning tool comes on the market. In addition to four full pages of new equipment, more than 40 new literature items are noted on the reply card.



Anaconda Forms Anaconda-Jurden Associates, Inc., Enters Design Engineering Field (1)

Clyde E. Weed, chairman of the board of the Anaconda Co. announced that Anaconda-Jurden Associates, Inc., a wholly owned subsidiary, had been formed and would offer complete service to world-wide industry in the planning, designing, engineering and supervision of construction of large industrial plants. Wilbur Jurden, long-time chief design engineer of the Anaconda Co., will be president and chief engineer of the subsidiary. Anaconda's engineering staff has designed many large plants— even for competitors in the copper industry. Requests to design plants had become so frequent that the subsidiary was formed to handle all comers.

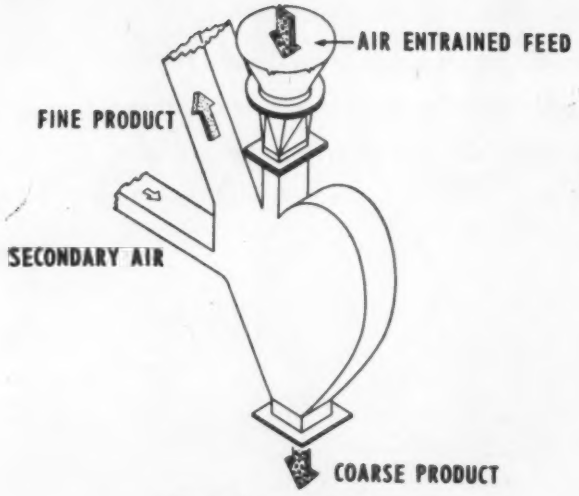
Anaconda's engineering department forms the new subsidiary, having about 300 employees. Since World War II, Anaconda's engineering staff has designed more than a billion dollars worth of construction—Erie Mining Co.'s taconite plant, Phelps Dodge's Morenci reduction works, Anaconda reduction works, Andes Copper, Chuquicamata, Anaconda Aluminum at Great Falls, Weed Heights, Bluewater, Inspiration's tank house, New Cornelia, modernization of El Paso, Cananea, Basic Magnesium, Inc.'s Henderson, Nev. plant, and many others. Presently the new subsidiary is working on a complete modernization of Laurel Hill for Phelps Dodge.



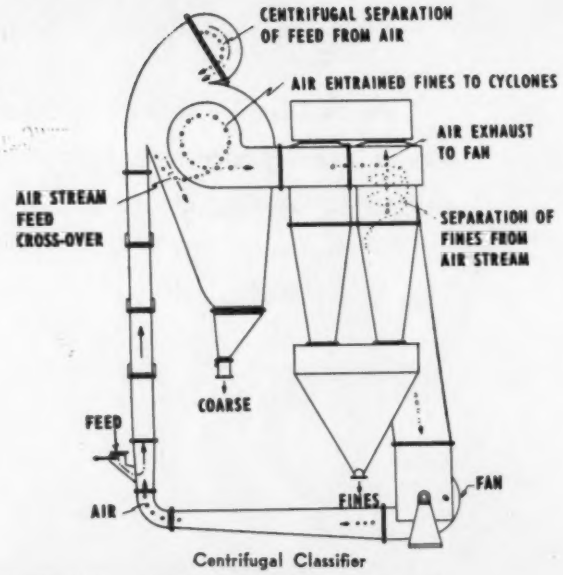
Sanford-Day Slusher Train Promises Tremendous Savings in Tunnel Driving (5)

Slusher Train equipment includes loader, S-D slusher train and a locomotive. Only two men are needed—one loader and one slusher operator. Train consists of S-D bottom automatic dump cars of any required number. Cars are dumped when complete round is mucked out. No car switching; no extra men. Overlapping ends on S-D cars permit the slusher to move muck from first car to all the other cars. Sanford-Day says that you can figure on loading 1 to 1½ tons a minute with the machinery shown above. Also, Sanford-Day has modified their Gismo Ramp Car mucking train so that either or both the Self-Loader and Gismo may be had in wheeled or crawler design. Mine cars shown are S-D overlapping-end one-door automatics.

For more information on new products and for copies of the literature, circle the proper number on the New Products reply card, give your name and address, and mail to E&MJ.



Gravity-Inertial Classifier



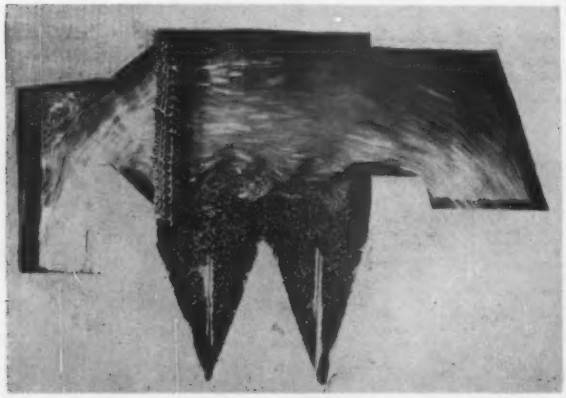
Centrifugal Classifier

Buell Engineering Develops Two Dry Classifiers For High Speed Sizing and Upgrading (2)

Gravitational-Inertial classifier which originated in Holland, and has been under development for three years for the domestic market, has been anounced by Buell Engineering Co., Inc. Device shown at left, above, consists of a top feed leading into an obtuse sizing chamber, and discharging from the chamber to a high-efficiency cyclone. Ground feed to be sized is pushed into the sizing chamber by a blower. Feed falls down a series of cascade steps laid across the fine product (above) outlet to the cyclone. Secondary air (which can be varied to change cut point) is admitted below the cascade. Fines are blown through the cascade and into the cyclone. Coarse falls into bin below. Fines that did not get out the first pass are picked up by the secondary air and recycled back to the cascade. Unit, less the cyclone, is small, about the size of an office desk; yet can handle up to 100 tpd, depending on cut point. It is recommended for cut points in the 50 to 200 mesh range. Union Carbide has one operating at Uravan.

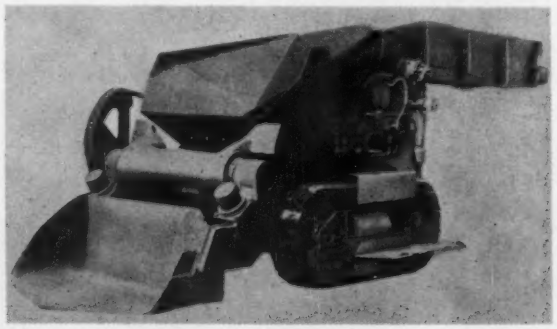
Centrifugal classifier is designed for 200 to 400 mesh cut points, and is available in sizes from 100 lb to 100 tph. Centrifugal classifier will extract from most feed materials more than 98% of the minus 325 mesh feed, with no oversize in the fines. In several installations, sizing capacity has to be increased from 10 to 300% over former method.

Feed is blown into the centrifugal chamber, where it is sized based on centrifugal force, and where stray fines and intermediates are recycled until they enter the fine or coarse fractions. Fines are caught in high efficiency cyclones.



Unique Water Table Solves Dust Problems (4)

Buell Engineering has devised a water table test apparatus on which the effects of duct and flume design on dust and air flow patterns can be studied. Duct or flume system leading to a planned electrostatic separator can be scaled down and assembled in the tank. Water flows through the scale model and indicates flow patterns (as shown in the photograph above) when aluminum powder is added to the water. Buell says that obstructions in duct work cause turbulence in water just as they do in air, and therefore the air flow characteristics can be studied and corrected using slow-moving water rather than air. For best operation, electrostatic precipitators must receive uniform air flow. Water table studies permit design and choice of baffles and guides to make the air flow pattern uniform to the collector.



Eimco Loader With Conveyor (6)

Eimco Corp.'s 635 continuous overcast loader and conveyor machine is crawler mounted (track mount also available), has storage bin capacity for about 30 cubic ft of material ahead of the conveyor. Unit features a wide bucket and an over-all length of 12 ft 4 in. to 18 ft 4 in. Unit has four air motors—three are 12hp and one is 7.5. Recommended air pressure is 90 psi. Loading capacity, depending on bucket size, is 50 to 80 cubic ft per minute.

Blaw-Knox to Market Refractories (11)

Major products to be handled by Blaw-Knox include high alumina and high grade fire and silica brick including all special shapes and a complete line of plastic cements and castables. The fact that Blaw-Knox has been a major supplier to the metal working industry where refractories are an important part of operations lead the company to enter the field.

Needle Pistol Derusts, Descales and Cleans Metal, Stone and Concrete Surfaces (3)

The Von Arx pistol operates on compressed air from conventional 80 to 100 psi compressors and uses 12.5 cubic ft per minute. Needles are driven by a hammer and anvil in the tool. Needles will float around bolts, nuts and obstructions. It is being used in Europe to derust; descale; clean weld seams, castings; to strip paint; chisel out pipe channels; rough or clean concrete, stone and brick; and de-fur boilers. The pistol raises very little dust. No danger of pushing the needles through material. Special non-sparking needles are available. The Marindus Co. is U.S. marketer of the product.

Truck Body Tilts, Raises or Lowers (9)

Leveloader, built by Thompson Trailer Corp., subsidiary of General American Transportation Corp., is equipped with a body that can be hydraulically tilted fore and aft, raised or lowered to conform to uneven ground or docks. General American also built the largest aluminum bottom-dump trailers ever. General American built units that carry 50-ton payloads of coal for Aluminum Co. of America at Alcoa's southern Indiana mine. Trailer bed measures 37 ft length, 11 ft width. A standard Euclid (335-hp Cummins diesel) tractor is used. Alcoa has six of these units.

Joy Enters Mineral Processing Equipment Field

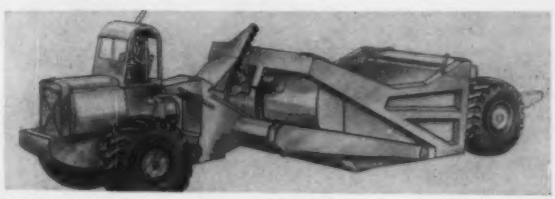
At a press conference held in the middle of September at Pittsburgh, Pa., Joy Mfg. Co. confirmed an earlier statement that Joy would soon announce their entry into the mineral processing equipment field. See *E&MJ* New Products Digest, September.

Joy has signed a licensing agreement with Carpco Research & Engineering, Inc., Jacksonville, Fla., to manufacture and service Carpco High Tension electrostatic separators for use in the iron ore industry. Last January, Carpco announced a revolutionary process for dry concentration of iron ore. Joy says that this is only the first step in a long line of mineral processing equipment to be marketed by Joy.

In the High Tension Process for iron ore (see *E&MJ*, January 1958) of magnetic and/or non-magnetic character, the ore is processed dry at better than 96% iron recovery, with finished products of 65% Fe or better. Carpco says that the High Tension step can be operated at about 4c a ton treated. Special separators (production size) have been designed that will handle 100 tph feed. Process will be important to desert regions and colder places like northern Canada where controlling water is a serious problem. Iron ore will be dry ground and sized, separated and pelletized.

Kaiser Purchases 100-Ton High Side Gondolas (7)

Six hundred of the largest gondolas available have been placed in service by Kaiser Steel Corp. at Eagle Mountain, Calif. to haul ore from the mine to Fontana, 164 miles away. Total weight of the gondolas loaded runs to 125 tons. Cars were built by Southern Pacific Railroad. First haulout totalled 100 cars carrying nearly 10,000 tons of ore—the heaviest cargo ever pulled over Beaumont Pass.



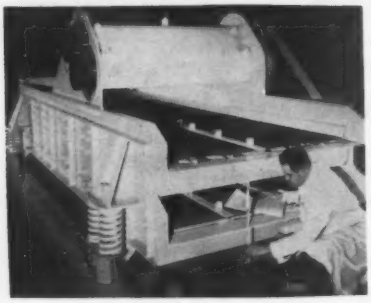
Goliath Bowl Scraper (16)

R. G. LeTourneau Inc. says that they'll be coming out with a monster bowl scraper in 70- and 100- (100 and 125 ton) yd capacity. We'll have a photo of the unit in November NPD, but in the meantime, here's an artist's conception of the Goliath.

Radioactive-Based Gas Detector (8)

Researchers at Mine Safety Appliances Co. discovered that measurements in parts-per-billion of gases are possible through the use of radioactive materials. Instrument, as yet unnamed, takes a gas sample, and chemically converts certain gases into a cloud of fine particles. Cloud borrows electrons from an ionization chamber, and the number of borrowed ions is measured to determine gas quantity. Radioactive source provides ions for the ionization chamber.

Vibrating Screens



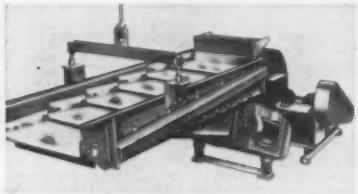
Heavy-duty Straightline horizontal vibrating screens, CL-Model 58, are available from Link-Belt Co. in single or double deck in 15 sizes from 4x8 to 6x16 ft. Screen decks bolt to the side plates. **(47)**

Newest addition to the Allis-Chalmers Mfg. Co. run-of-mine vibrating screens is an 8x14 ft double deck Model XXH. Unit shown here is handling 7-in. limestone making 5½ and 3 inch separations with peak loads up to 1760 tph. **(48)**

Roll Crushers (49)

Eagle Crusher Co. has two new roll crushers, a 24x20 and a 30x24 in. machine. Rolls are manganese steel in either smooth or corrugated, or one of each. Maximum roll opening is 3 in. Smaller unit needs from 75 to 125 hp, while larger requires 100 to 200 hp.

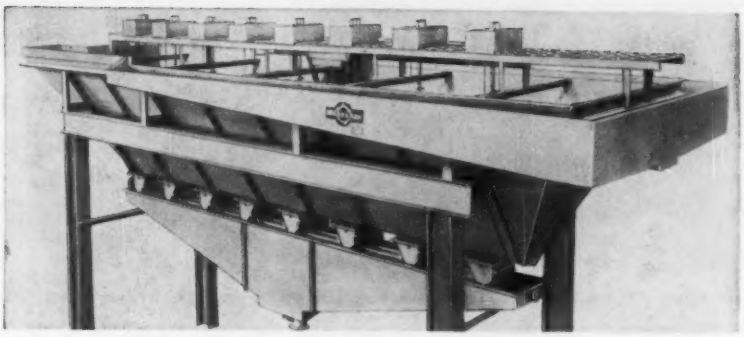
Feeders



Heavy duty and extra heavy duty electromagnetic feeders with direct panel heated troughs are now available as drying feeders from Syntron Co. Unit dries by vibrating solids over cascade of electrically-heated panels. **(52)**

For controlled feeding of a wide range of bulk solids at high rates, Link-Belt Co. suggests their new Straightline geared counterweight design. Unit can handle lumps up to 36 in. dia. Wide range of sizes, shapes and special features possible. **(53)**

High speed, variable rate feeder, with a maximum capacity of up to 3 tons per hour, is available from Syntron Co. Unit employs electromagnetic vibrators. Standard flat pan trough measures 5 in. wide and 24 in. long. Special pans on request. **(51)**



Sand Classifier Uses Stalling Motors to Control Valves (50)

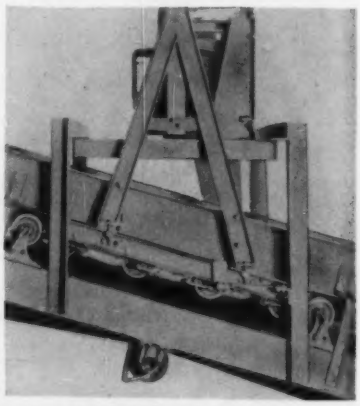
Recommended for service where large quantities of water must be handled in a raw feed from pumps or dredges, the new McLanahan & Stone Corp. sand classification tanks employ a hydraulically-operated bottom discharge valve to settle and classify sand down to 200 mesh. When material settles to the bottom and builds up in a tank, the material covers a 4-blade propeller, stalling a control motor which then opens the discharge valve, dumping the load. Excess water overflows over three sides of the tank into launders.

Transmission Fluorimeter (55)

Ball Brothers Research Corp. Model FL-500 Fluorimeter has high sensitivity and can be used in the detection of trace amounts of uranium. Readings are obtained from a digit dial instead of a meter. Literature on request.

Supercharger Controls (56)

Applied initially to Caterpillar Tractor Co. DW20 and DW21 wheel tractors, the Airesearch System developed by Garrett Corp., has improved turbocharging, permitting up to 10% higher travel speeds without loss of rim pull. In addition it decreased specific fuel consumption, improved acceleration and reduced smoking, according to Garrett Corp.



Weighing Devices (54)

Weighing & Control Components, Inc. has developed a unitized, pneumatic, belt conveyor scale which is easy to install on existing flat belt or troughing conveyors. Variety of sizes to cover a wide range of capacities are available. Rugged, sensitive, the scale uses no knife edges, pivots or bearings.

These Items Are For Sale

"Drawing for good reproduction," a 32-page manual published by the National Association of Blueprint & Diazotype Coaters, 1001 Connecticut Ave., N. W., Washington 6, D. C., is printed in two colors, stressing the essentials of reproducing good documents. Price $1. Write direct to the Association.

How universal construction systems can help design working models of practically any type of drive or mechanism is the subject of an 80-page manual prepared by FAC Division, 9551 Grand River Ave., Detroit 4, Mich. Erector-set type units of Swedish design are available from the company. Price $1. Write direct to FAC Division, Overseas Commodex Corp., address above.

For Your Files

This selected manufacturers' literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Exploration and Mining

HEINRICHS Geoexploration Co. offers the usual mining and engineering geophysical equipment, interpretation and services in addition to a unique, continuous, mobile recording magnetometer. Check for literature. **(60)**

ROCK DRILL—Atlas Copco leaflet E 1115 describes the Tiger rock drill. 2pp. **(61)**

ENGINEERING features of the General Motors Corp. Firebird III experimental gas turbine vehicle are discussed in a brochure prepared by the corporation. 35pp. **(62)**

UTILITY TRACTORS in the Allis-Chalmers D Series are presented in a 6-page bulletin (UT-103-587). **(63)**

ALUMINUM bodies and telescopic hoists to increase payloads, reduce maintenance and lengthen tire life are detailed in Penn Body Div., Hockensmith Corp. literature. 4pp. **(64)**

CONCRETE cutting lance that uses the Oxweld ACL-3 powder is illustrated in a 4-page folder (F1153) prepared by Linde Co., Div. of Union Carbide Corp. **(65)**

STANDARDIZED right angle Coniflex bevel gear units developed by Airborne Accessories Corp. are set down in a 4-page release. **(66)**

HEAT RECOVERY system—a fuel saving feature for air compressors—developed by Atlas Copco is illustrated in 4-page bulletin (E 857 b). **(67)**

WEATHERIZED 35-kw portable, lightweight generator sets, the Allis-Chalmers G-226, are illustrated in 6-page bulletin (BU-412). **(68)**

MOTOR GENERATOR SETS—5 kw, 6.25 kva and 400 cycles—and accompanying control panels are presented in Kato Engineering Co. literature. 2pp. **(69)**

VOLTAGE REGULATORS for 600 v and below in single-phase to 240 kva and three-phase to 720 kva are detailed in General Electric Co. Inductrol bulletin (GEC-1450). 23pp. **(70)**

CABLE SPLICERS, binders and terminals in the Canton line of American Mine Door Co. are set forth in an 8-page bulletin (149). **(71)**

PROPER LUBRICATION of heavy duty equipment is the subject of Lubriplate brochure prepared by Fiske Brothers Refining Co. (CFT-58). 6pp. **(72)**

SERVICE LIFE of wire rope can be lengthened substantially by proper lubrication and safe storage, according to Red-Strand service bulletin (103) prepared by Leschen Wire Rope Div., H. K. Porter Co., Inc. **(73)**

GEAR REDUCER catalog No. 5802 published by Western Gear Corp. contains complete engineering and selection information on the Speed-Master line which is available in a wide range of ratios up to 10,000 hp. **(74)**

THE ESCO 500-ton swaging press makes it possible to install many swaged wire rope sleeves in the same time as it ordinarily takes to make one hand splice according to Electric Steel Foundry Co. bulletin No. 208A. 8pp. **(75)**

MATERIAL HANDLING equipment—hooks, safety links, truck steps and back-up alarms from the E. D. Bullard Co. are cataloged in eight pages. No. 58. **(76)**

GUIDE TO THE SELECTION of office copying machines has been published in eight pages by Copease Corp., showing the advantages of the Copease system over other methods. **(77)**

Metal and Mineral Processing

SLIDE RULE offered by Smith Engineering Works will help an operator select and buy the best and most economical crusher. All sizes and types of Telesmith crushers are shown. **(79)**

OLIVER continuous rotary drum filter for the mineral process industry is illustrated in a 24-page two-color bulletin (7200) released by Dorr-Oliver Inc. **(80)**

MICRONIZER fine grinding machine by Sturtevant Mill Co. is illustrated in a 4-page bulletin. **(81)**

INDOX V ceramic magnet drum separator, newest addition to the Stearns Magnetic Products line, is illustrated in an 8-page bulletin (1051). **(82)**

E&MJ NOT GOOD AFTER APRIL 1, 1959

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled. **OCT. 1958**

1	17	33	49	65	81	97
2	18	34	50	66	82	98
3	19	35	51	67	83	99
4	20	36	52	68	84	100
5	21	37	53	69	85	101
6	22	38	54	70	86	102
7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
14	30	46	62	78	94	110
15	31	47	63	79	95	111
16	32	48	64	80	96	112

Name .....

Title .....

Company .....

Address .....

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P.L.&R.)
NEW YORK, N. Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in The United States

Postage Will Be Paid By—

McGRAW-HILL PUBLISHING COMPANY, INC.
ENGINEERING & MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 36, N. Y.

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P.L.&R.)
NEW YORK, N. Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in The United States

Postage Will Be Paid By—

McGRAW-HILL PUBLISHING COMPANY, INC.
ENGINEERING & MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 36, N. Y.

E&MJ NOT GOOD AFTER APRIL 1, 1959

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled. **OCT. 1958**

1	17	33	49	65	81	97
2	18	34	50	66	82	98
3	19	35	51	67	83	99
4	20	36	52	68	84	100
5	21	37	53	69	85	101
6	22	38	54	70	86	102
7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
14	30	46	62	78	94	110
15	31	47	63	79	95	111
16	32	48	64	80	96	112

Name .....

Title .....

Company .....

Address .....

E&MJ NEW PRODUCTS DIGEST (*Continued*)

FLEX-CHECK rubber-lined valves brochure (957) from Allen-Sherman-Hoff Pump Co. describes the company valve line for abrasives, corrosives and acids. 2pp. **(84)**

PACKLESS rubber-lined pumps for abrasives, corrosives and acids are demonstrated in Allen-Sherman-Hoff Pump Co. bulletin (857). 4pp. **(85)**

HIGH EFFICIENCY cyclone dust collectors in the Ducon Co. line are presented in an 8-page bulletin (C-958). **(86)**

SWECO vibrating screen separators —18-, 30- and 48-in. sizes—are detailed in Southwestern Engineering Co. catalog (S-581). 20pp. **(87)**

WAGON DRILL (FM-4) and Wagonjack (JHM) are described in Ingersoll-Rand literature. 8pp. **(88)**

BIN LEVEL indicators and controls are being introduced by Convair in the Bin-Vue line. Two-page data sheet on Model B tells where and how it is used. **(89)**

DOWTHERM 209 ebullient-cooling heat-transfer medium has just recently been introduced. Twenty-page bulletin (164-7) describes its use and function. **(90)**

DE-AERATING HEATER designed for use with small steam generating plants is illustrated in 6-page Graver Water Conditioning Co. bulletin (WC-118A). **(91)**

ROTARY positive pressure blowers, gas and vacuum pumps designed by Sutorbilt Corp. are discussed in bulletin S65C. Line is designed to handle gas volumes up to 20,000 cfm. 20pp. **(92)**

CONTINUOUS chlorine drying—a Milton Roy application engineering data sheet A-58-1 tells how Hooker Chemical uses the Milton Roy Model LMD-31-74 controlled volume pump in Hooker's two-stage system. 2pp. **(93)**

EQUIPMENT for all water and waste treatment is presented in Graver Water Conditioning Co. bulletin WC-117. 4pp. **(94)**

TEN WAYS to regenerate ion exchangers, a reprint from *Power*, is available from Graver Water Conditioning Co. 4pp. **(95)**

RESEARCH AND DEVELOPMENT facilities available to customers at Mixing Equipment Co., Inc. fluid mixing laboratory are illustrated in a 6-page bulletin (B-516). **(96)**

COMPACT, BUT NOT PORTABLE ph meter—the Coleman Instruments, Inc. Compax—is discussed in a 2-page flier. **(97)**

HYDROGEN ZEOLITE cation exchange water softeners are detailed in Cochrane Corp. bulletin (3M1057). 8pp. **(98)**

SUBMERGED COMBUSTION system—the Thermal Sub-X System—is illustrated in Thermal Research & Engineering Corp. bulletin (115). 4pp. **(99)**

PROCESS INSTRUMENTATION and equipment in the B-I-F Industries, Inc. line—flow tubes, telemeters, controls, valve positioners, meters, scales and chlorine feeders—are described in bulletin 100-R5 from Builders-Providence, Inc., Div. of B-I-F Industries, Inc. 8pp. **(100)**

DEW POINT can be measured simply and inexpensively with the Dew-O-metric indicators developed by the Anders-Lykens Corp., Div. of Milton Roy Co., according to a two-page data sheet (957) **(101)**

ELECTRONIC CONTROL of process variables is possible with the Foxboro Co. electronic Consotrol strumentation system, according to literature available. New line includes transmitters, recorders, controllers and valve operators. **(102)**

PRESSURE, DRAFT, differential and level are directly measured, indicated and transmitted by the new Bailey Multi-Pointer gage. Four-page bulletin (M42-2) signals the features and use of the gage. **(103)**

FATTY ACIDS and aliphatic organic compounds—over 150 products—are listed in Armour & Co. catalog. 8pp. **(104)**

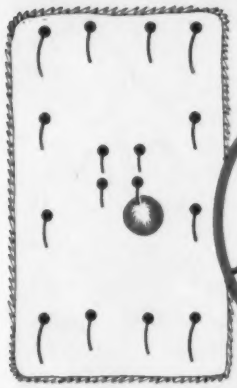
ORGANIC CHEMICALS available from Eastman Kodak Co.'s Distillation Products Industries Division are tabulated in the new catalog list No. 41—more than 3700 items. 232pp. **(105)**

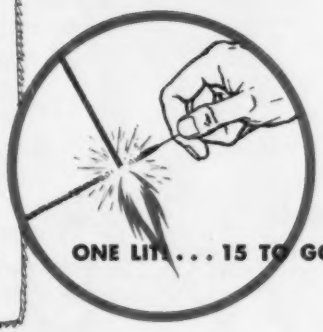
HYDROGEN is the title of a 36-page bulletin prepared by Girdler Corp., Div. of Chemetron Corp. Production, purification, plants and uses are detailed. **(106)**

HIGH-IMPACT and anti-corrosion rigid polyvinyl chloride plastics have been developed by Bakelite Co., Div. of Union Carbide Corp. Available in compound form for use in fabricating chemical and mineral process equipment. **(107)**

HIGH-TEMPERATURE MATERIAL—Haynes Silicon Nitride—will withstand over 3,000 deg F conditions, and is resistant to attach from molten aluminum, lead, tin and zinc. 8pp. **(108)**

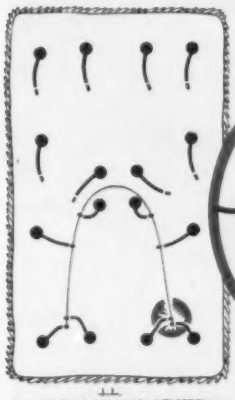
CORE DRILL, the Acker Drill Co. Hillbilly designed for mineral prospecting, is described in 4 pages. **(109)**

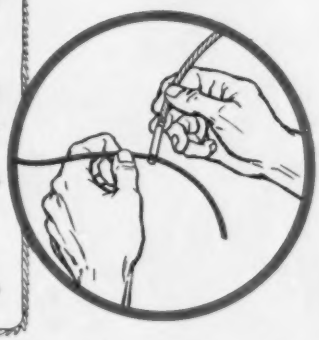




When Lighting Safety Fuse in a Round... *Why take chances?*

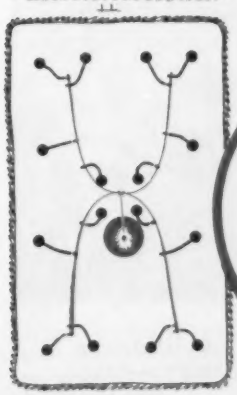
NOW -- hook up in planned rotation with IGNITACORD®





Instead of trimming the fuse at the face and then lighting each fuse "by hand," use this improved and safer way to shoot each hole in its correct firing order, *while your blaster is in a place of safety.*

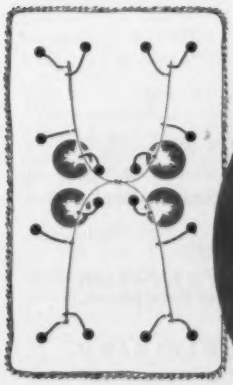
Cut the Safety Fuse in *equal* lengths and attach the blasting cap. On the other end of the fuse, attach an Ignitacord Connector. This is a metal shell similar to a detonating cap but color-marked with two colored bands for identification. The base contains an ignition charge and a slot to hold the Ignitacord. Prepare the primer cartridges and load the holes in your usual way.



1. Connect all holes with Ignitacord. This is a flexible cord with a core of Thermite. It acts like a continuous hot wire lighter, burning at a uniform rate with an intensely hot flame at the zone of burning. Time delay between holes is governed by the length of Ignitacord between them. Color marks at one-foot intervals make it easy to measure off each distance. Place the Ignitacord in each Connector slot and press the top flap down firmly to secure it in place. This also insures positive ignition of the connector.

2. Connect your lines of Ignitacord at the lighting point, tying them together firmly, as shown in the diagram. When all is ready to fire, light the Ignitacord at this point with a match. *Walk* to a place of safety.

3. The Ignitacord will ignite each connector, which in turn will ignite each length of Safety Fuse in your planned rotation. You'll get a blast you can be proud of!



THE ENSIGN-BICKFORD COMPANY

Simsbury, Connecticut • Since 1836

Safety Fuse, Primacord® and Detacord® Detonating Fuse, Ignitacord®, Quarrycord®, Pyrotechnical Devices and Blasting Accessories.

Ignitacord is made in two types. Type A is green — burns at a rate of 8 to 10 seconds per foot. Type B is red — burns at a rate of 16-20 seconds per foot. Each type is packed on spools containing 100 feet. Connectors are packed in stout cardboard boxes of 100 each.

Ignitacord is sold on the West Coast under the name of Spittercord® by the COAST MANUFACTURING & SUPPLY COMPANY.

WARNING *Ignitacord must not be used as a substitute for safety fuse, or in any place where an open flame is undesirable.*

IGNITACORD®

and CONNECTORS

IG-1

Amusement park operators* know that their rides must be exciting to be successful. But with the lives of riders and onlookers at stake, operators rely on *quality* wire rope to ensure . . .

a safe ride

Safety comes first, wherever wire rope is used. You may save a few pennies on the purchase of a "bargain" rope. But it will cost you *more* than you bargained for, if it results in injured personnel and wrecked equipment. Make sure you get *quality* wire rope—buy Wickwire Rope.

**Picture shows the Rocket Ride at Palisades Amusement Park, Fort Lee, N. J. Wickwire Rope provides the only support for each of these planes.*

CF&I

WICKWIRE ROPE

A CF&I PRODUCT

LOOK FOR THE YELLOW TRIANGLE

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver El Paso • Farmington (N. M.) • Fort Worth • Houston • Kansas City • Lincoln • Odessa (Tex.) • Oklahoma City Phoenix • Pueblo • Salt Lake City • Tulsa • Wichita • **PACIFIC COAST DIVISION**—Los Angeles • Oakland • Portland San Francisco • San Leandro • Seattle • Spokane • **WICKWIRE SPENCER STEEL DIVISION**—Boston • Buffalo • Chattanooga Chicago • Detroit • Emlenton (Pa.) • New Orleans • New York • Philadelphia 6347

NOW THERE ARE 7*

ANNOUNCING

the newest model in the L-W Adams† grader line

the 135-hp POWER-Flow® 550 with torque converter

- **Forward speed to 26.4 mph — reverse to 23.5 mph**
- **Power and speed automatically proportioned to meet all working conditions**

Now... to give you an even more complete line of work-matched L-W Adams motor graders... LeTourneau-Westinghouse has added a seventh high-speed machine to the series. It's the new, heavy-duty POWER-*Flow* 550 grader with torque converter.

The introduction of this new 135-hp L-W model allows you to choose with greater accuracy the exactly-right Adams grader — heavy-duty, general-purpose, or utility — to meet your working requirements.

With single-stage L-W torque converter, the new POWER-*Flow* 550 automatically balances speed and applied power to match your varying load... automatically apportions the engine drive to provide more power or more speed as needed in your grading work. This means that the L-W POWER-*Flow* grader handles every assignment at the fastest possible speed, and with the greatest efficiency.

Cuts gear-shifting, reduces wear

Delays due to stalling are ended. When bucking heavy loads, the need for frequent gear-shifting is eliminated. Operator gets more work done with less effort. Converter also shields transmission and power-train from damage caused by shock loads... reduces wear and maintenance expenses.

Shifts forward-reverse instantly

In any gear range, POWER-*Flow* 550 power-shifts instantly — from forward to reverse, reverse to forward — by the simple movement of a rocking treadle-type foot pedal. This leaves operator's hands free for steering, or to manipulate other controls.

Cutting ditches... shaping shoulders... sloping banks... spreading fill... final grading... maintaining roads... plowing snow — on all these assignments, 135-hp POWER-*Flow* 550 will keep your work ahead of schedule.

Write us for complete details and work specifications on 550 POWER-*Flow*.

OPTIONAL EQUIPMENT—available for POWER-*Flow* 550 are Power-Shift Moldboard, Scarifier, Cab, Bulldozer, Push Plate, Jabco Elegrader, V-type Snow Plow and Wing, and Snow-Blo Wing.

Check these other important features of the L-W 550 POWER-Flow

- **Power Steering (optional)** — You retain the "feel" of hand steering, with hydraulic power doing the work.
- **Double-Action Hydraulic Braking System** — Pedal-operated service brake automatically applies pressure to transmission brake, as well as to 2 tandem drive-wheels.
- **Rubber-Mounted Engine** — Reduces vibration transmitted to machine... less wear and tear on equipment, less operator fatigue.
- **Foot Accelerator** — Even in heavy traffic, driving the 550 POWER-*Flow* is as easy as driving a truck. Foot accelerator or hand throttle may be used when working.

* Complete L-W Adams line of graders includes: 190-hp POWER-*Flow* 660, and 135-hp POWER-*Flow* 550 with torque converters; with standard transmission: 160-hp "660", 123-hp "550", 115-hp "440", 80-hp "330", and 60-hp "220" utility grader.

Choice of Cummins or General Motors diesel engine on the six larger models.

† Trademark G-1912-G-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

product:

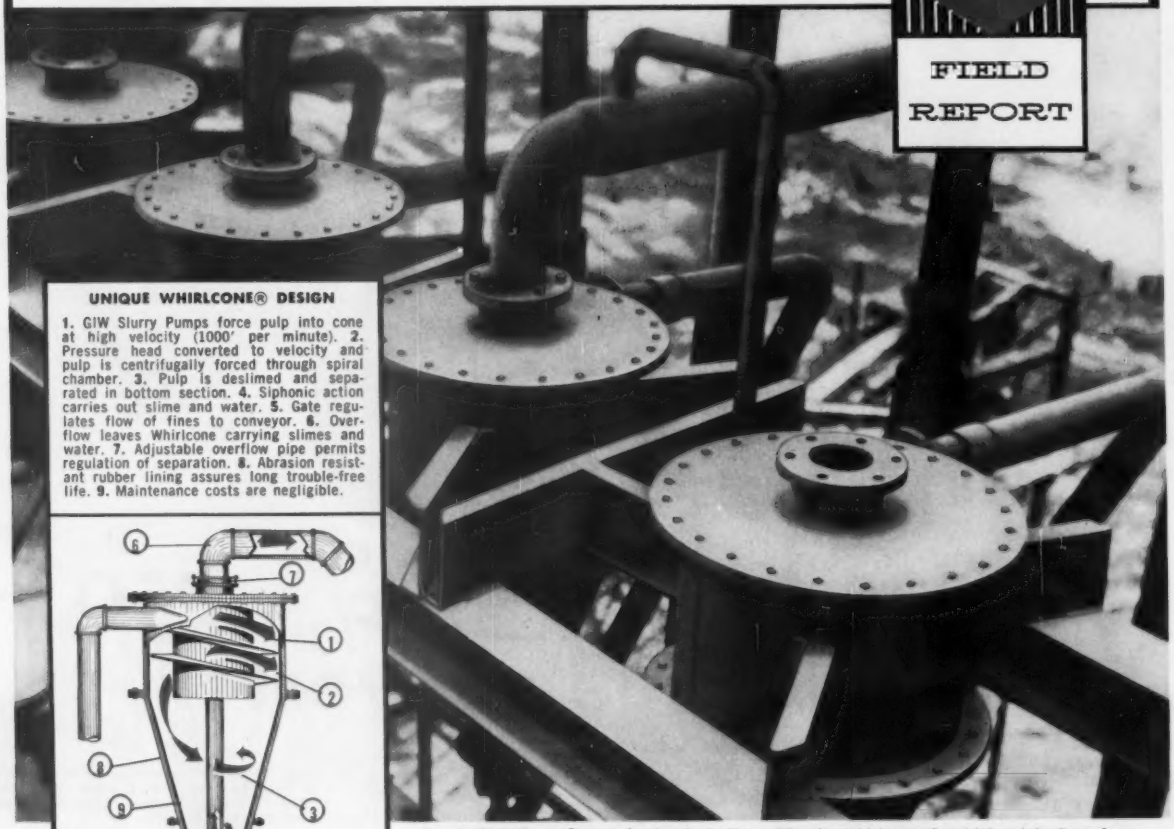
COTTRELL WHIRLCONE® SEPARATORS

customer:

BECKER COUNTY SAND & GRAVEL CO.

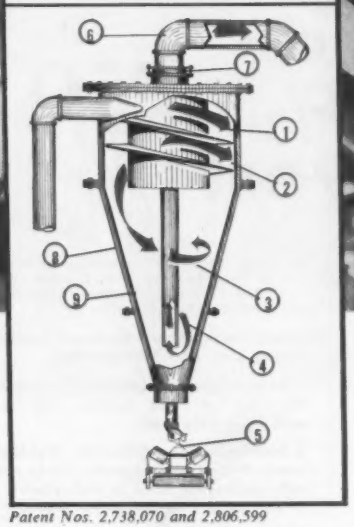
GIW

FIELD REPORT



UNIQUE WHIRLCONE® DESIGN

1. GIW Slurry Pumps force pulp into cone at high velocity (1000′ per minute). 2. Pressure head converted to velocity and pulp is centrifugally forced through spiral chamber. 3. Pulp is deslimed and separated in bottom section. 4. Siphonic action carries out slime and water. 5. Gate regulates flow of fines to conveyor. 6. Overflow leaves Whirlcone carrying slimes and water. 7. Adjustable overflow pipe permits regulation of separation. 8. Abrasion resistant rubber lining assures long trouble-free life. 9. Maintenance costs are negligible.



Patent Nos. 2,738,070 and 2,806,599

Tough GIW Slurry Pumps feed pulp to these 25″ dia. Whirlcones®, which retain fines from classifier overflow. Maximum recovery rate is 20 tons per hour per cyclone. The cones will handle material from −12 mesh to lightest slime.

Whirlcone® Separators solve difficult fine recovery problems.

The retention of fines in the −50 plus 200 mesh range posed a disturbing problem for the Becker County Sand & Gravel Co., of Cheraw, S.C., primarily because the large amount of water used in processing the sand and gravel washed out the desirable fines with the minus 200 slimes.

Fourteen 25″ dia. Whirlcone® wet type cyclones installed parallel in four Becker plants solved this problem completely. Operating an average of 8 hours daily, they extract up to 100 tons of clean, fine sand per hour from wash water while the minus 200 mesh slime is discarded.

Recovered fines are used to bring sand up to specifications. Thousands of tons of valuable sand, formerly lost, soon paid for the low cost of the Whirlcones®.

GIW's highly efficient Whirlcones® are also being used in the mining fields to deslime, degrit, classify, concentrate, make dam and mine backfill and to dewater or thicken where the overflow can be returned to the process or it can be discarded.

They are available in diameters from 6″ to 50″. Capital cost including the pump is 20 to 50% of conventional classifiers.

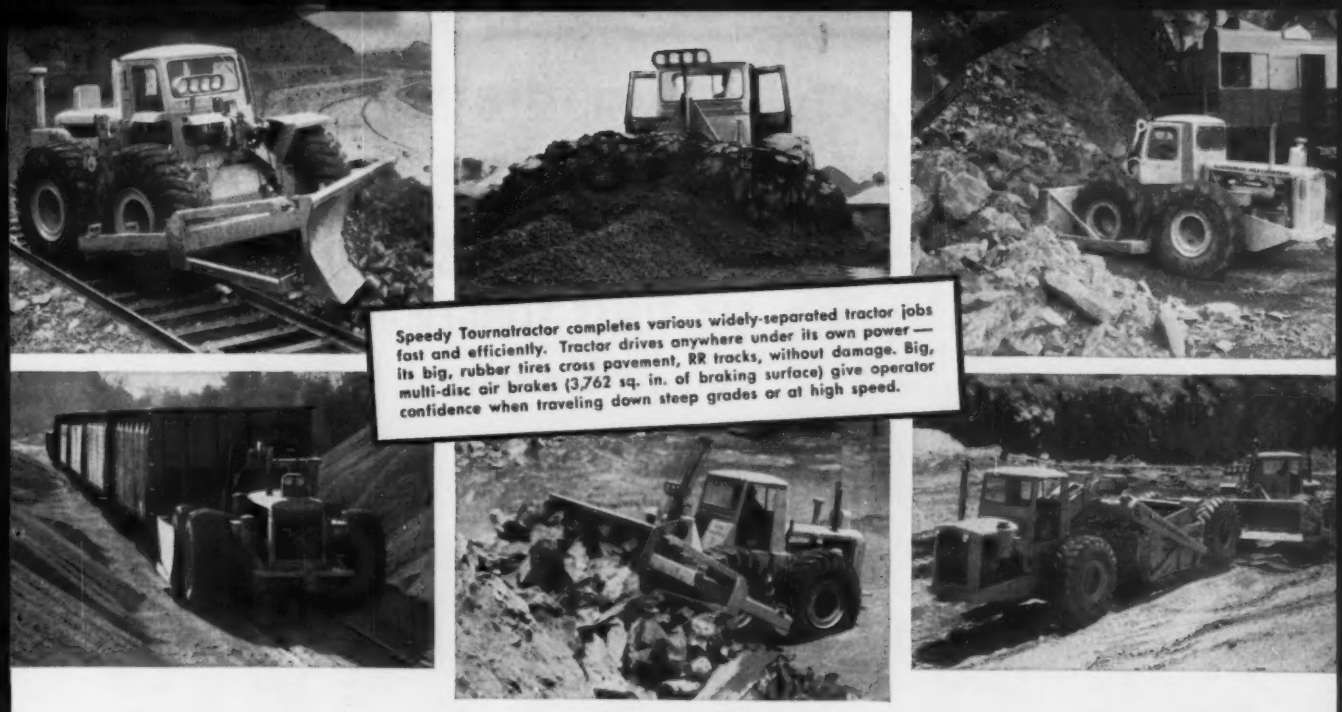
If you are losing fines from material −12 mesh to lightest slimes, write today. Recommendations and literature will be forwarded promptly.

COTTRELL ENGINEERING
Division of
GEORGIA IRON WORKS CO.

GIW

Manufacturers of pumps, dredges, separators and accessories.

AUGUSTA • GEORGIA



Speedy Tournatractor completes various widely-separated tractor jobs fast and efficiently. Tractor drives anywhere under its own power — its big, rubber tires cross pavement, RR tracks, without damage. Big, multi-disc air brakes (3,762 sq. in. of braking surface) give operator confidence when traveling down steep grades or at high speed.

A "sure-fire" way to CUT PIT COSTS

When modernizing your pit operations, don't overlook the savings you can make by replacing 2 or more slow-moving track-type tractors with a fast, rubber-tired tractor, to handle your scattered pit and road clean-up. This *one* speedy tractor can complete the same (or more) assignments — without need for extra machines and operators.

These "sure-fire" savings are possible with a fast, rubber-tired LeTourneau-Westinghouse Tournatractor®.

1. One L-W tractor can often replace 2 to 3 crawlers, cutting your cost for operating and maintenance, fuel, and spare parts.

2. Between pit chores, your fast, rubber-tired tractor can handle haul-road maintenance and drainage problems. Good haul roads help to lower your hauler repair costs... keep these production units rolling fast and safely, to complete more cycles per hour.

3. Mobile, 210-hp Tournatractor easily drives to new areas of operation under its own power, at speeds to 17.2 mph. It goes right to work to clear land, strip overburden, build access roads. Rubber-tired tractor needs no flatbed trailer, truck, and extra manpower to load and transport unit to remote operations.

4. Cleans-up around plant area, dresses and seals stockpiles, eliminates excessive waste.

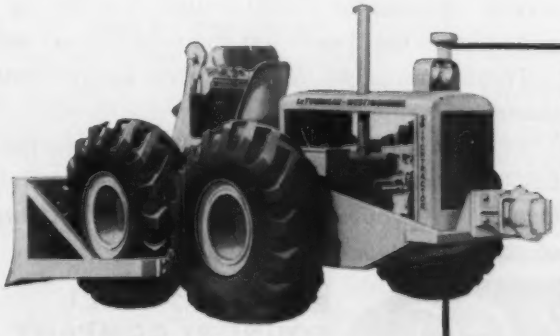
5. Tournatractor spots rail-cars, tows equipment — reduces costly time waiting for switch engines.

6. In winter, with V-type snow plow, L-W tractor plows snow from roads, loading and dumping areas — keeps pit operations open and safe in all kinds of weather.

Every tractor assignment — anywhere on your property — can be handled quickly and efficiently by versatile Tournatractor. And, if your pit normally sidelines equipment during its off-season, this mobile L-W tractor can be rented out to nearby pits, contractors, counties, or municipalities. It's easy to keep Tournatractor busy all year long!

Try it in your pit

Let us demonstrate a LeTourneau-Westinghouse Tournatractor in your pit. Write or phone for complete information. No obligation.



Standard Type E railway car coupler is one of 10 Tournatractor attachments available to help you cut tractor costs. With coupler, this powerful off-track switcher spots and groups rail-cars fast. Big, rubber-tired wheels on SwitchTractor† straddle rails, ride on ballast and tie-ends — deliver double the tractive effort of steel-wheeled switchers on steel rails.

†Trademark CT-1811-MQ-1

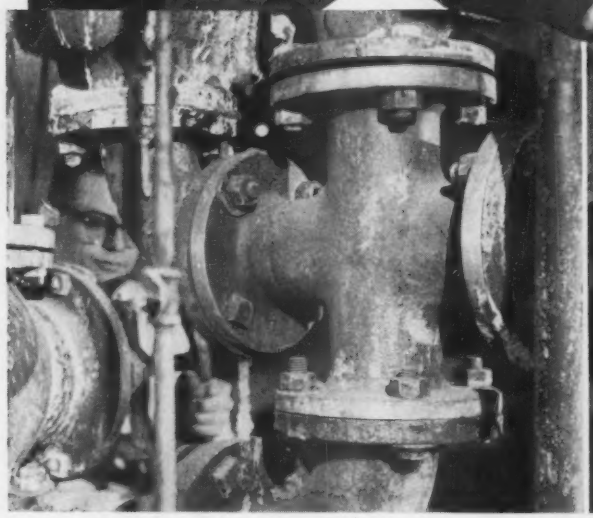
LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

"ESCO FITTINGS HAVE LASTED SIX TIMES LONGER and still show no possible sign of failure"

Mr. D. Baker, operating superintendent, inspects ESCO fittings installation.



. . . reports the Bunker Hill Co., Kellogg, Idaho.

"About seven years ago," explains The Bunker Hill Co. Electrolytic Zinc Plant Maintenance Superintendent C. H. Neubauer, "we started replacing our fittings, as they failed, with *ESCO* Alloy 45S (Type 316) stainless fittings. We are getting anywhere from six times to indefinitely longer service life from the *ESCO* fittings. The cost of *ESCO* fittings is no more, and in some cases even less than the fittings we were previously using."

These fittings carried a corrosive slurry containing zinc sulphate in the electrolytic zinc plant.

You can solve your problems due to corrosion, heat and abrasion with ESCO Stainless Steel Fittings. They are available in a wide range of alloys. Call or write your *ESCO* dealer or an *ESCO* engineer today for an analysis of your fittings requirements.

ESCO®

ELECTRIC STEEL FOUNDRY COMPANY

2179 N. W. 25TH AVE. • PORTLAND 10, OREGON
MFG. PLANTS AT PORTLAND, ORE. AND DANVILLE, ILL.
Offices in Most Principal Cities
ESCO INTERNATIONAL, NEW YORK, N. Y.
IN CANADA ESCO LIMITED

How Wisconsin pit strips overburden fast and at low cost

Working along edge of deep pit, 138-hp D Tournapull loads an average of 7½ yds. of clay and sand in 44 seconds. Fast-acting electric controls, big air brakes, and high traction tires assure operator and machine safety.

The Wilson and Shipler Limestone Pit at Beloit, Wisconsin, produces crushed stone, which is sold as subbase or top dressing for roads. As their mining activity expands, so too, the job of overburden removal becomes larger and costlier. But owners of this Wisconsin pit find that there is a sure, modern way to handle the job fast and at low cost. They use a speedy, rubber-tired LeTourneau-Westinghouse D Tournapull® 9-yd. scraper. Here's how this pivot-steer dirtmover performs:

Loads 7½ yds. in 44 sec.

Removing sand and clay from limestone formation, scraper is push-loaded with average of 7½ yds. in 44 sec. — according to co-owner Carroll Wilson. Load, haul, spread and return cycles of 2200′ are completed in 3 min. 42 sec. That's 13 trips per 50-min. hour. Working 10 hours a day, this single D Tournapull strips an average of 975 yds. of overburden daily.

Earns extra profits

When stripping work is completed Wilson and Shipler don't let their Tournapull scraper sit idle. They use it for miscellaneous dirtmoving assignments around the pit . . . or they send this mobile scraper out to handle nearby land-leveling contract jobs for extra profit.

You be the judge

Let us arrange to demonstrate the D Tournapull scraper at your pit. Time its cycles, measure its performance for yourself. We're sure you'll find this 138-hp LeTourneau-Westinghouse unit a good producer on overburden work, and a worthwhile "handyman" for clean-up work, haul-road construction, drainage improvement, and other self-loading jobs. Call us for full details.

DP-1797-QMJ-1

Reduce equipment inventory

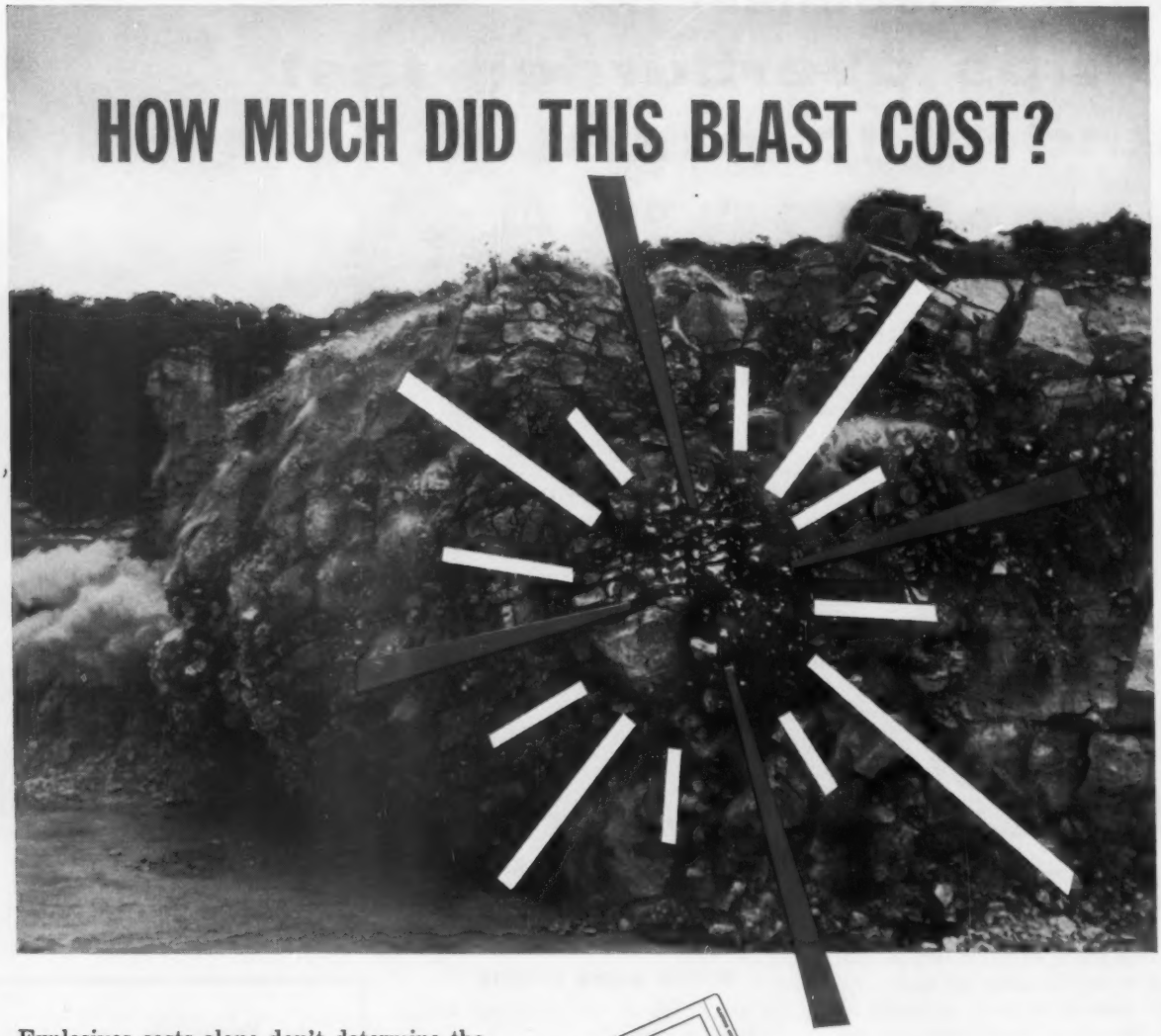
For less than ¼ of the cost of the Tournapull with scraper, you can get an 11-ton Rear-Dump trail-unit to interchange with original scraper. You'll then have a two-way high-production tool to help you reduce pit hauling costs and equipment inventory. Other trail-units to increase prime-mover usefulness also available.

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

HOW MUCH DID THIS BLAST COST?



Explosives costs alone don't determine the value of a given blast. The explosives you use have a direct effect on the whole operation: drilling, digging, hauling and crushing.

You can find out, quickly and easily, the true, complete cost on any blast by using the new, simplified computing method developed by Atlas. It's called the Blasting Cost Chart, and it's yours without cost or obligation.

Use this new method to learn your real blasting costs. It will help you plug profit leaks and come out money ahead in your blasting. Your nearest Atlas representative will show you how the chart works, and you can keep the actual figures within your own organization.

EXPLOSIVES
DIVISION

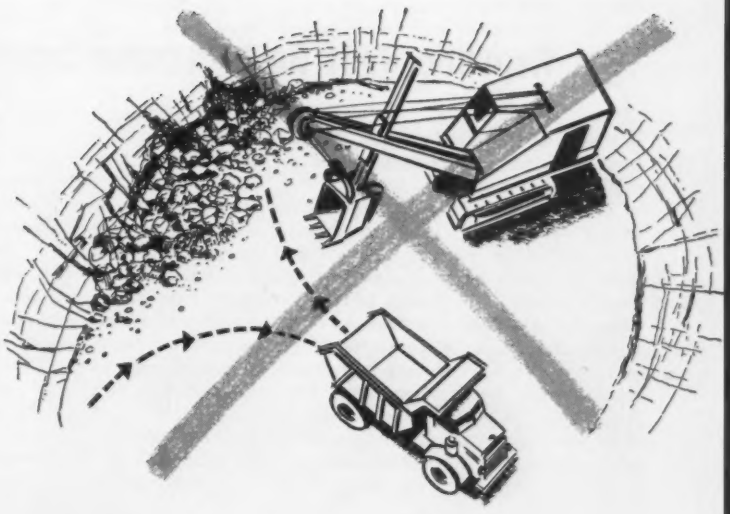
ATLAS
POWDER COMPANY

WILMINGTON 99, DELAWARE

offices in principal cities

SHORT TURNS
...speed hauling in restricted areas

Even though most haulers make good time on straightaway haul and return, many of them make a poor showing on the entire work cycle. That's because of maneuvering difficulties in restricted load and dump areas. Conventional trucks, for instance — with full-length, 1-piece frame, hydraulic bowl hoist, and automotive-type steer — often slow down production and increase haul costs because of time-wasting maneuvering delays.



Maneuverability is no problem to the pivot-steer LeTourneau-Westinghouse Rear-Dump. Bowl on this off-road L-W hauler is connected to 2-wheel Tournapull® prime-mover by a geared kingpin. Big, instant-acting electric motor swings prime-mover 90° right or left for quick, easy spotting under shovel or at dump. Short-turning L-W hauler makes U-turns in less than its own length, in *only about 70% of length* with bowl raised. Result? Tournapull Rear-Dump saves time in the cut and dump...delivers more tonnage per day.

U-Turn Widths

Model	Tonnage	Length	Bowl Down	Bowl Raised
B	35	36'7"	35'0"	27'0"
C	22	29'6"	28'8"	20'8"
D	11	24'10"	24'8"	18'8"

R-1898-G-1

Ask for full specifications on L-W Rear-Dumps

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

CERTIFIED BY TEST, PROVED BY PERFORMANCE

Republic Roof Bolts Assure Consistent Top-Holding Power

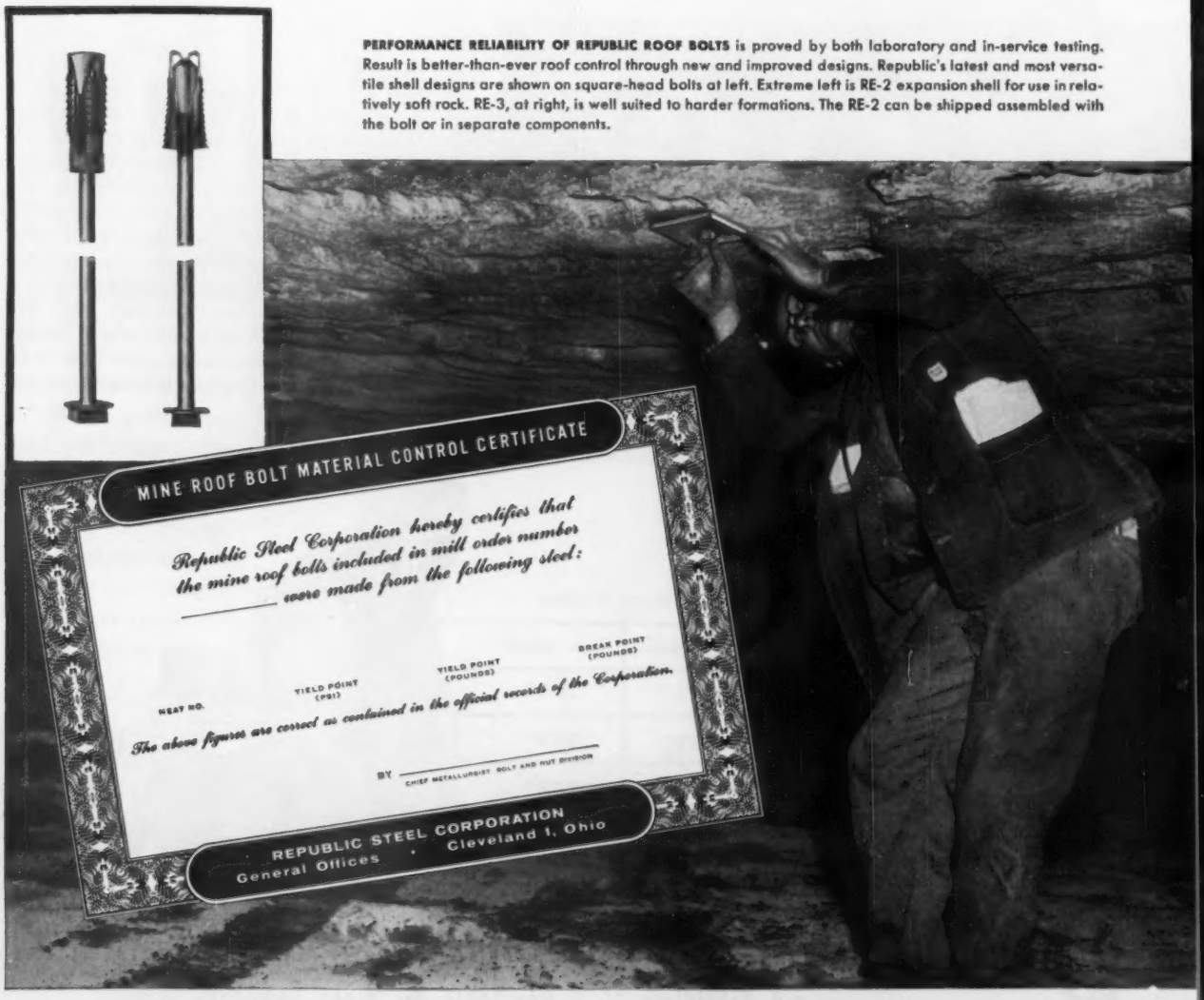
When you specify Republic Mine Roof Bolt Assemblies, you get two-way assurance of uniformly superior top-holding power.

First, Republic's exclusive Certification Program is direct evidence of the high standards maintained to protect roof bolt quality. Samples of every heat of steel used are tested to destruction to establish finished bolt performance. The results of these tests are entered on Material Control Certificates which accompany all roof bolt shipments, demonstrating that physical properties meet or exceed the suggested mining standards as approved by the American Mining Congress and American Standards Association.

Second, a continuous field-testing program to verify performance under actual service conditions is conducted in Republic's own mines. Before a new design is marketed, it must pass these tests. Complete data are assembled concerning its effectiveness in various types of strata using different methods of placement and spacing. Moreover, records are maintained to establish long-term performance.

In addition to laboratory and field testing, Republic helps you increase roof-control reliability by offering the most complete selection of roof bolt assemblies available from a single manufacturer. Wherever roof bolting is practical, Republic can furnish the type and size best suited to overhead conditions.

All of these facts make Republic Roof Bolt Assemblies your best choice for uniform top-holding power throughout your bolted-roof areas. For further information, contact your Republic representative or mail coupon.


MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE
Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:
HEAT NO.
YIELD POINT (PSI)
YIELD POINT (POUNDS)
BREAK POINT (POUNDS)
The above figures are correct as contained in the official records of the Corporation.
BY _____
CHIEF METALLURGIST BOLT AND NUT DIVISION
REPUBLIC STEEL CORPORATION
General Offices • Cleveland 1, Ohio

PERFORMANCE RELIABILITY OF REPUBLIC ROOF BOLTS is proved by both laboratory and in-service testing. Result is better-than-ever roof control through new and improved designs. Republic's latest and most versatile shell designs are shown on square-head bolts at left. Extreme left is RE-2 expansion shell for use in relatively soft rock. RE-3, at right, is well suited to harder formations. The RE-2 can be shipped assembled with the bolt or in separate components.

BOLTED ASSEMBLY PERFORMANCE can be no better than the fasteners used to hold it together. This is the reason it pays to specify REPUBLIC Bolts and Nuts. 20,000 standard and 8,000 special types and sizes are available to meet practically any requirement. Each is a product of integrated manufacturing control extending from ore mining to final inspection. Result is uniform high quality . . . the basis for absolute dependability. For facts, mail coupon.

REPUBLIC'S NEW TRUSCON STEEL BUILDINGS PERFORM WELL as permanent or temporary shelter for mine personnel, equipment, or material. These "Budget Buildings" are delivered as a complete package including roofing, siding, windows, doors, and hardware. They are easy to erect or dismantle and re-erect to meet changing needs. Sizes include 32-, 36-, 40-, 44-, and 48-foot widths; 12- and 14-foot heights; and any required length. Parts are galvanized to eliminate painting. Send for data.

REPUBLIC PLASTIC PIPE PROVIDES TOP PERFORMANCE in handling mine water disposal problems. Both Flexible Polyethylene and Semi-Rigid Kralastic Pipe are available to satisfy a very broad range of applications. Both are lightweight and easy to handle, cut, and join. Made of chemically inert materials, Republic's Plastic Piping is impervious to acids, alkalies, metallic salts, and other corrosive wastes found in mine water. Send coupon for details.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. EJ-5523-R
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

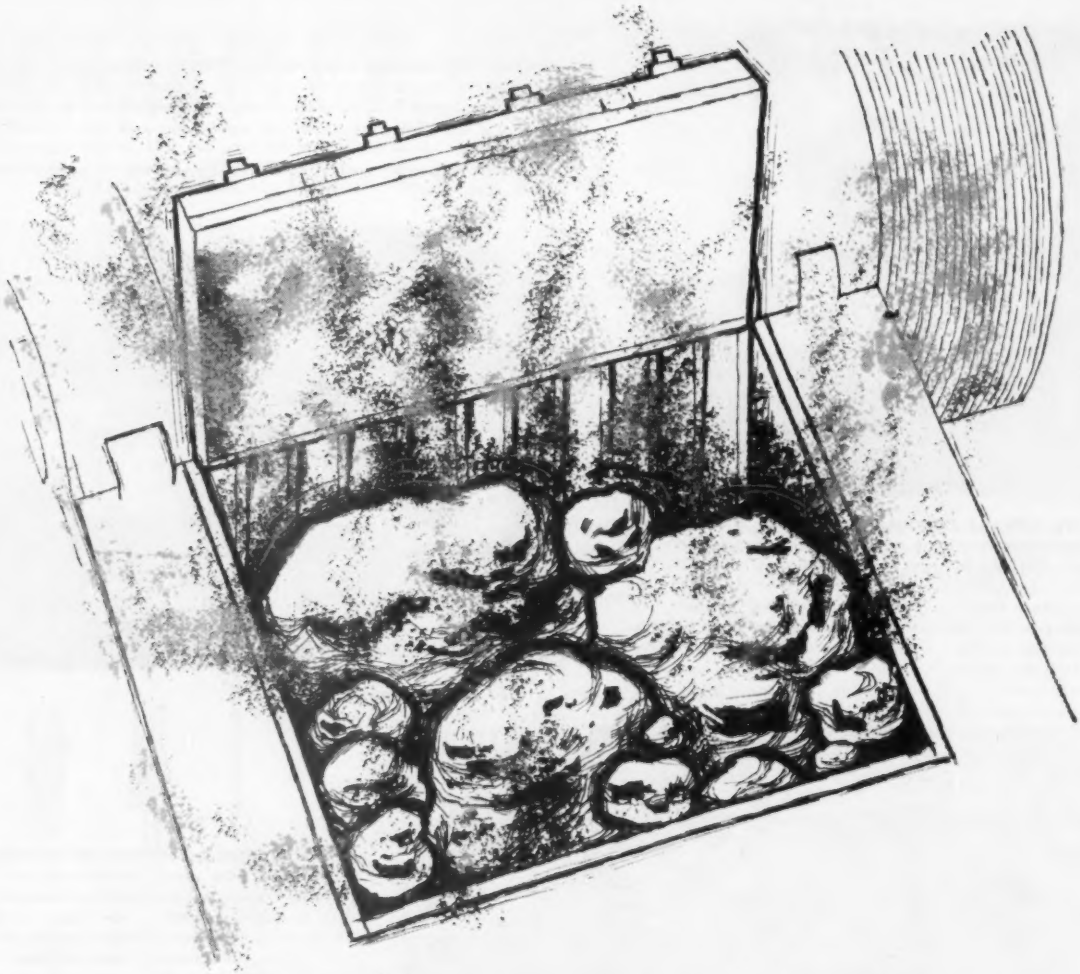
- ☐ Mine Roof Bolts
- ☐ Truscon Steel Buildings
- ☐ Bolts and Nuts
- ☐ Plastic Pipe

Name_____ Title_____

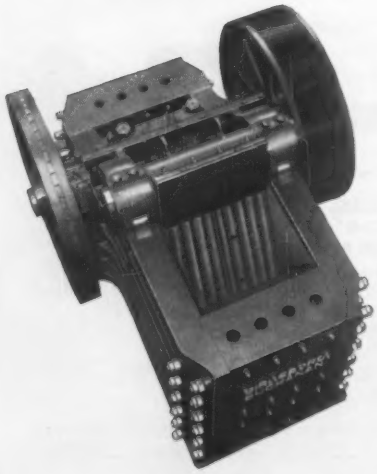
Company_____

Address_____

City_____ Zone_____ State_____



crushes costs, too . . .



. . . is a statement that definitely applies to the BIRDSBORO-BUCHANAN all-steel Deep Frame primary jaw crusher. The longer swing jaw helps produce the most economical crusher production available today. There are many other cost savings, too. Jaw plates are reversible. Offset toe lugs double jaw plate life. Field performance figures are real eye-openers. Contact your Birdsboro representative for the facts. *Main Office, Engineering Department and Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.

World-Wide Agent Representation. Contact home office for nearest representative.

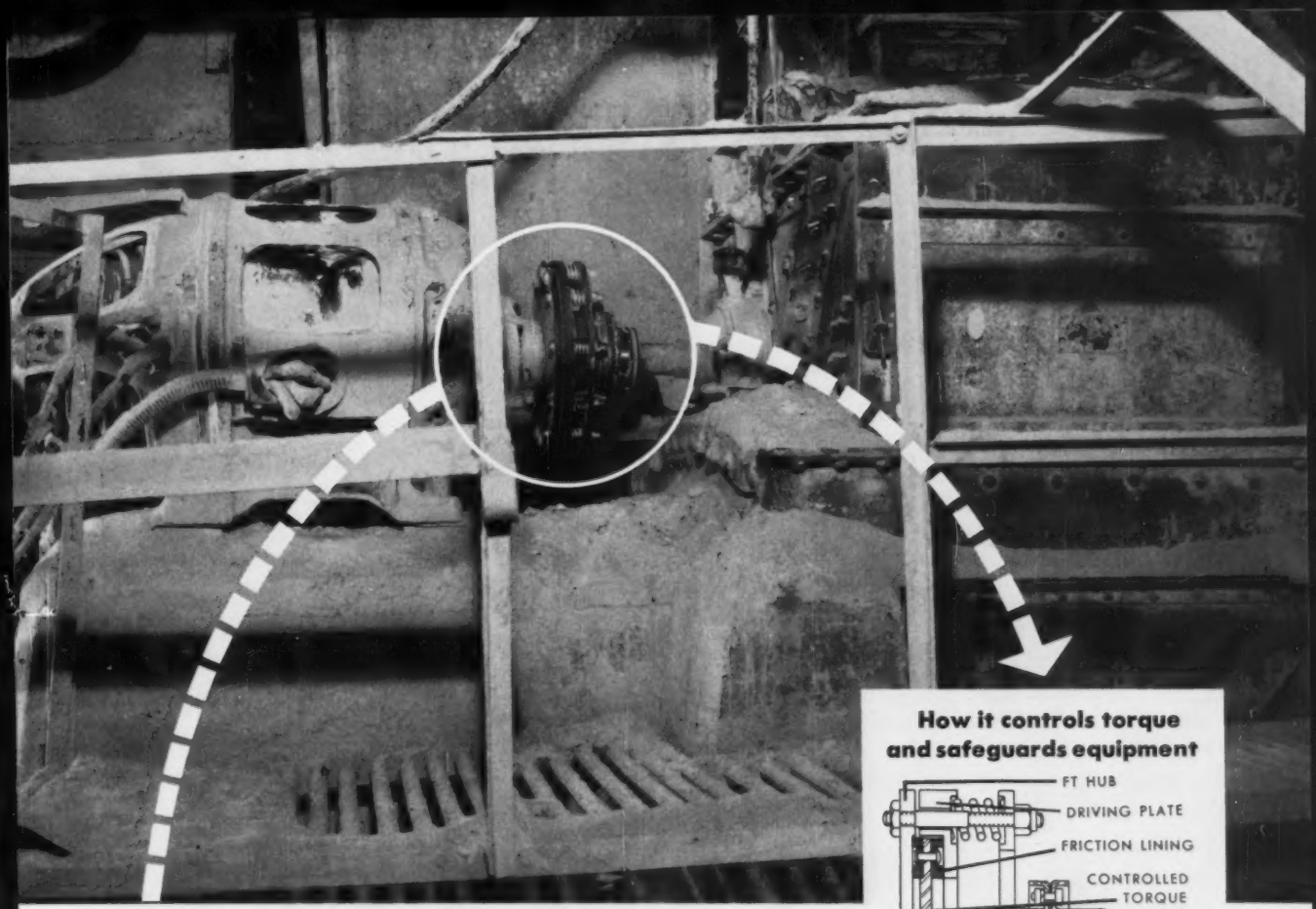
Canadian Representative & Manufacturer: John Inglis Co., Ltd., Toronto, Canada

CR 22-58

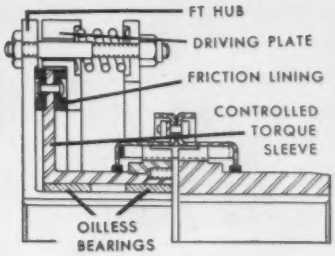
BIRDSBORO

STEEL FOUNDRY AND MACHINE CO.

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design ROLLS: Steel, Alloy Iron, Alloy Steel



How it controls torque and safeguards equipment



Protect machines from overload damage with FALK Controlled Torque Couplings

The above picture shows a Falk Controlled Torque Coupling connecting a 150 hp motor to a hammermill. Formerly, when tramp iron got into the mill, it was necessary to rewind the motor at least twice a year. But, in the 2½ years after installing a Falk Controlled Torque Coupling, no motor repairs were required. *That is real saving!*

Wherever overload danger exists, a Falk Controlled Torque Coupling gives positive protection against machinery damage from excessive torque or jams. This unique coupling has an adjustable friction slip clutch which can be set at *any* predetermined torque limit. Thus, transmission of dangerous shocks is prevented...overloads are limited...shaft breakage is eliminated.

Another big advantage is that, when the cause of the overload is removed, the entire coupling will rotate and transmit power without resetting, and *without replacing parts or repairing the coupling*....And, the Controlled Torque Coupling incorporates the famous Falk Steelflex torsional resilience to smother ordinary shock and vibration, plus the ability to accommodate shaft misalignment....Consult your Falk Representative or Authorized Falk Distributor. **Ask for Bulletin 4100.**

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

Representatives and Distributors in many principal cities.

Here (as in photo), the torque-control hub is shown mounted on driving shaft. From this hub, power is transmitted through friction lining to controlled torque sleeve. Load to be transmitted is determined by the (pre-set) pressure on friction lining. In case of overload, this hub still rotates until power is shut off—but the rest of the coupling and the driven machine will slow down or stop.

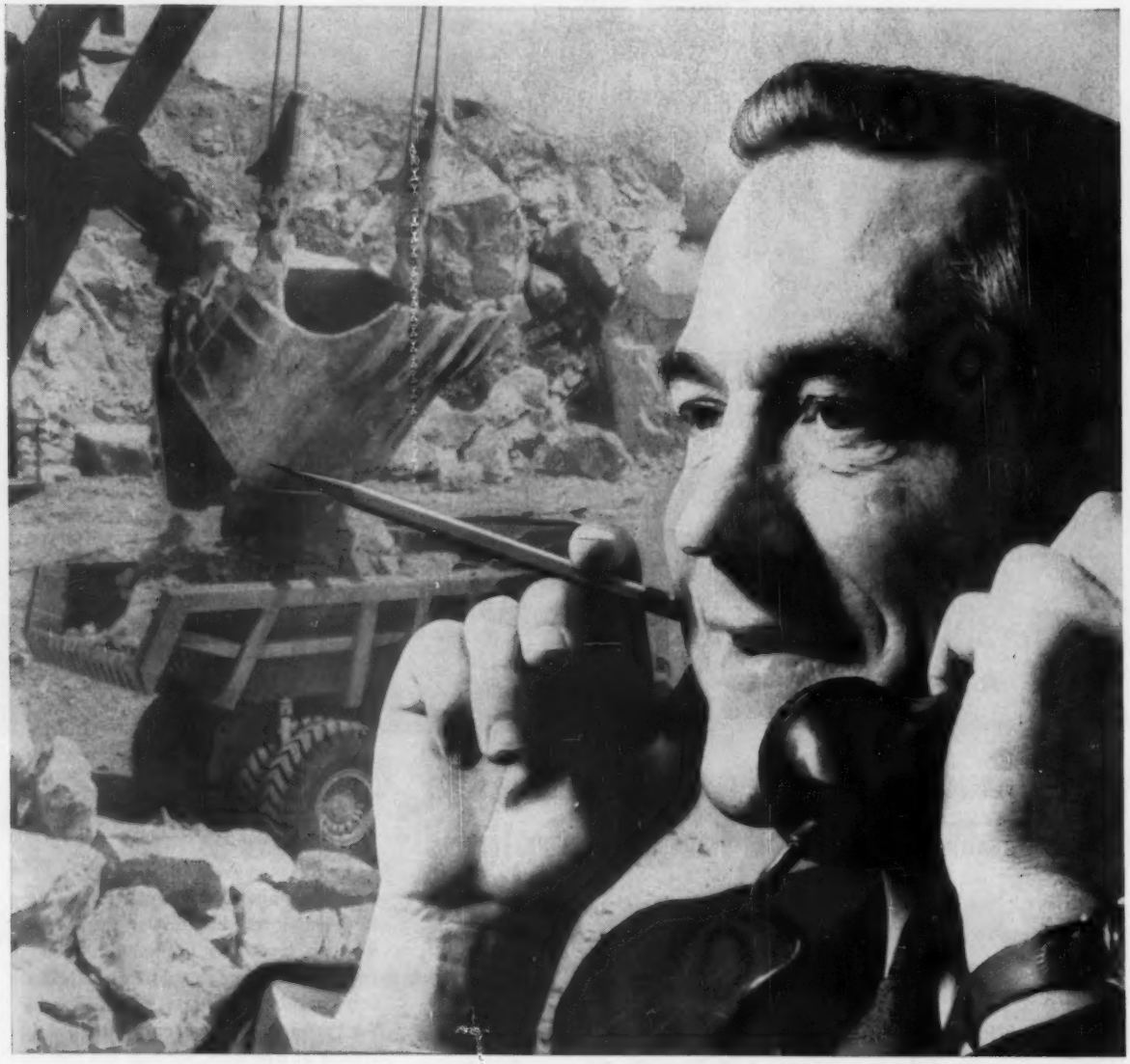
Motor Shut-off Control

By adding an automatic cut-out switch with V-belt connection to driven shaft, motor can be stopped immediately. With the standard hub mounted on driven shaft, the switch opens the electric circuit when speed of switch falls below predetermined value.

FALK

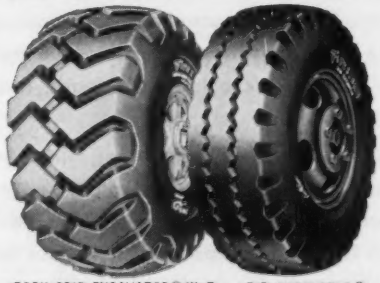
...a good name in industry

The man with the sharp pencil picks Firestone!



SHOCK-FORTIFIED TIRES MADE WITH FIRESTONE RUBBER-X REDUCE DOWNTIME, LOWER HAULING COSTS!

Where pit mines punish Off-the-Highway tires, records prove that Firestone Off-the-Highway tires are delivering new lows in tire costs! The two big reasons are Firestone Rubber-X and Firestone S/F (Shock-Fortified) Nylon cord! Combined with Firestone S/F Nylon, Firestone Rubber-X adds extra strength to every Firestone tire! Tough Firestone treads and sidewalls defy cuts in the roughest going. Firestone S/F Nylon bodies shrug off bruising shock and impacts. Count on Firestone Off-the-Highway tires to turn down-time losses into worktime profits! Call your Firestone Dealer or Store for tires or tire service.



ROCK GRIP EXCAVATOR® W. B. RIB EXCAVATOR®
TUBELESS OR TUBED

WHEN ORDERING NEW EQUIPMENT ALWAYS SPECIFY FIRESTONE TIRES.

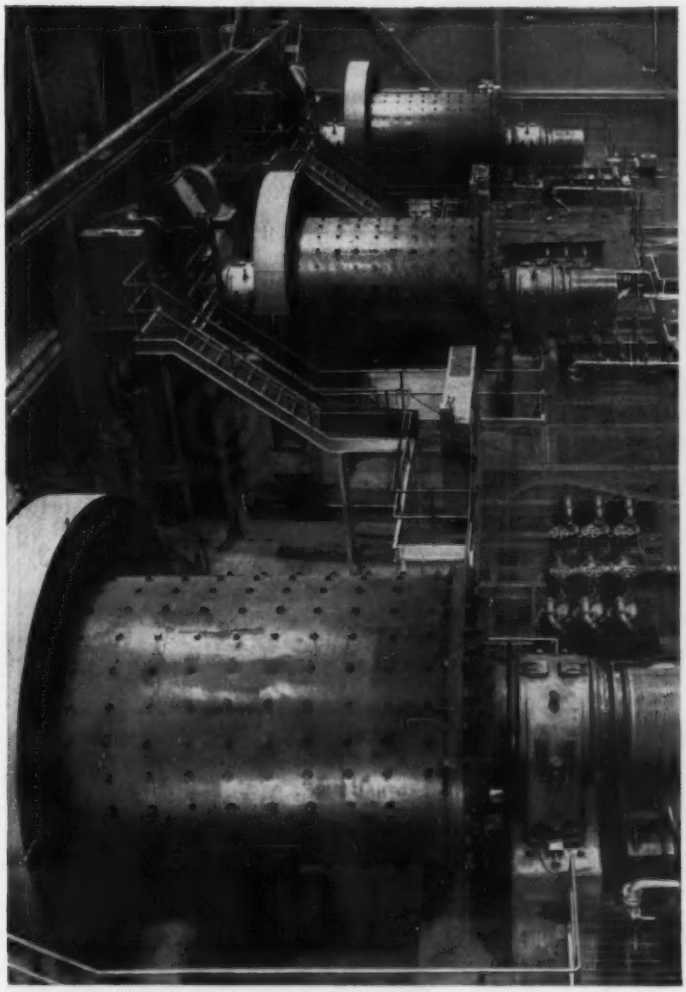
Enjoy the Voice of Firestone every Monday evening on ABC television

Firestone

BETTER RUBBER FROM START TO FINISH

Copyright 1958, The Firestone Tire & Rubber Company

SIFTING TONS OF ORE TO FIND A TON OF IRON



The Moose Mountain Beneficiation Plant recently built for Lowphos Ore Limited in the Sudbury Basin region of Ontario, Canada, incorporates the latest developments in processing methods and equipment.

The run of mine ore is crushed in three stages, first in a 66″ x 84″ Jaw Crusher then in cone crushers in closed circuit with screens, resulting in a uniform size feed to the beneficiation plant.

In the mill the ore is ground first in rod mills, is cobbed, then reground in ball mills and is passed through three stages of magnetic separation. The end result is an iron ore concentrate of high iron and low silica content ready for shipment to the steel mills.

The ore, from an open pit mine at nearby Moose Mountain, is composed of very hard magnetic taconites. Iron content averages 32 to 34 per cent.

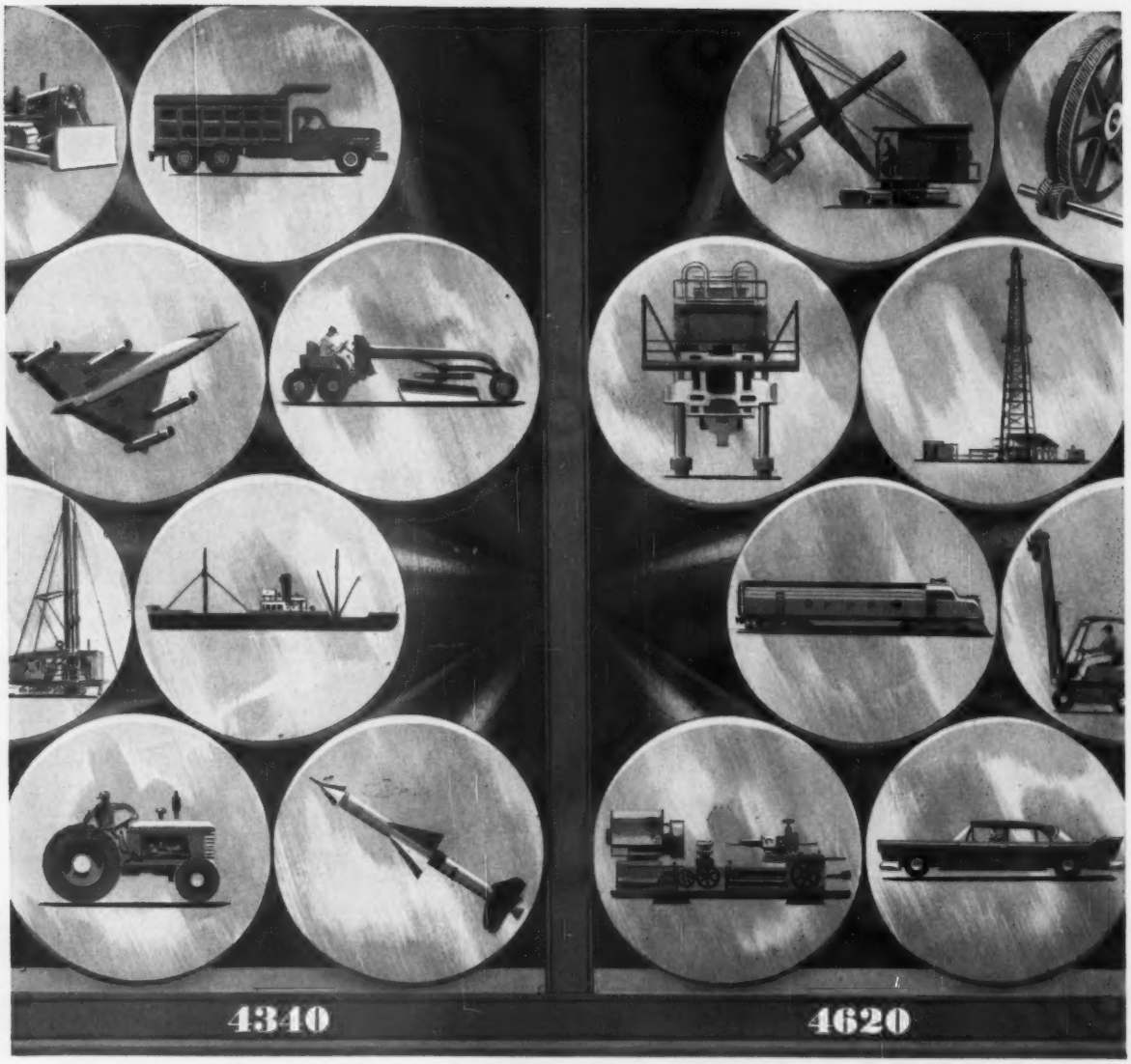
Lowphos Ore, Limited, owner of both the mine and the beneficiation plant, is a subsidiary of National Steel Corporation, an associate of The M. A. Hanna Company.

Canadian Bechtel Limited was responsible for the engineering, procurement and construction of the Moose Mountain Plant – a significant development in one of Canada's most important industries.

BECHTEL

BECHTEL CORPORATION
Engineers and Builders for Industry
SAN FRANCISCO
Los Angeles • New York • Houston

CANADIAN BECHTEL LIMITED
Toronto • Vancouver



No matter what you make...

look to these two general purpose steels to standardize, simplify, and save money!

4340 THROUGH-HARDENING

4340 stands alone among medium carbon steels in its ability to provide maximum strength, ductility, toughness and resistance to fatigue in parts of medium to heavy cross section.

4620 CARBURIZING

4620 is a carburizing type that has consistently proved itself the ideal steel for a wide variety of carburized parts. 4620 is easy to carburize and has a minimum tendency toward distortion in heat treatment.

AMERICAN STEEL WAREHOUSE ASS'N.

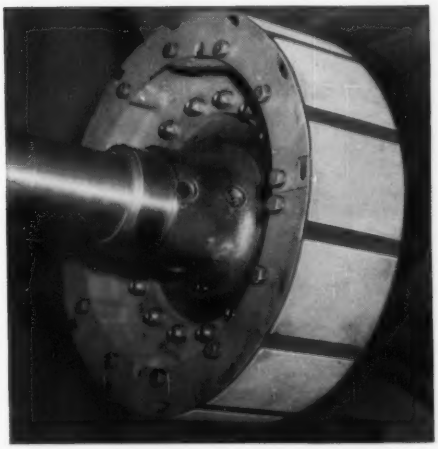
Easy to Get *. . . Both these steels are carried by many Steel Service Centers from coast to coast* . . . ready for delivery on a "next door" basis. For a list of names and addresses of Steel Service Centers that carry AISI 4340 and 4620, write us.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street New York 5, N.Y.

INCO TRADE MARK

New B.F. Goodrich Hi-Torque Brakes help C.F. Replogle Co. cut cycle time



Full circle stopping power of B.F. Goodrich Hi-Torque Brake allows safe hauling in higher gear — because it stops heavy equipment twice as fast as conventional shoe brakes.

CIRCLEVILLE, OHIO — After months of actual operating experience with the new B.F.Goodrich Hi-Torque Brake, C. F. Replogle Company reports "a definite cycle time reduction". Replogle, prominent contracting firm in Ohio and surrounding states, attributes this reduction entirely to the new brake "which allows safe hauling in higher gear".

With the new brakes installed for comparison tests on tractor-scraper combinations and heavy dump trucks, Replogle discovered many other advantages over conventional two-shoe brakes. For instance, maintenance down-time is reduced considerably, since the brakes are self-adjusting throughout the life of the lining. Job capabilities are expanded because the brakes give smoother, faster stops with less chance of fade—enable Replogle to run on terrain operators considered unsafe using conventional brakes.

See how the *full circle* stopping power of B.F.Goodrich Hi-Torque Brakes can mean safer, more economical, more profitable operation of your own off-road equipment. Whether your field is construction, mining or logging, send for free booklet—The B.F.Goodrich Hi-Torque Brake. Gives operating features, specifications and test results. Write B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Troy, Ohio.

B.F.Goodrich Hi-Torque brakes

High in the Peruvian Andes

RIO PALLANGA gets Maximum Profit with CYANAMID REAGENTS

Optimum cost-plus-tails varies for every ore and property in every mining district as every metallurgist knows.

But the most economic recovery at a particular mill can only be attained by careful evaluation of all milling costs, patient testing . . . and the right combination of Cyanamid Reagents. RIO PALLANGA proves that!

SINDICATO MINERO RIO PALLANGA treats 350 tpd of an unusual lead-zinc ore by straight flotation. By study of reagent combinations and overall mill economics, the mill staff working with a Cyanamid Field Engineer evolved this very low-cost reagent set-up:

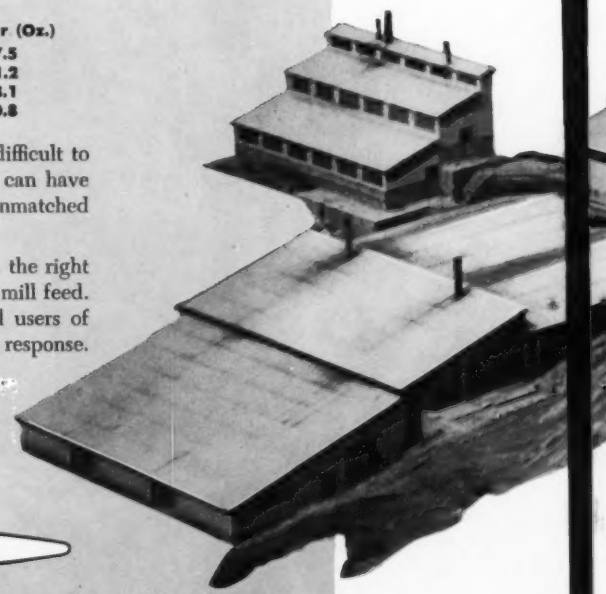
Lead Flotation	Lb/ton	Zinc Flotation	Lb/ton
AEROFROTH® 70 Frother	0.017	SODIUM AEROFLOAT® Promoter	0.074
AEROFLOAT® 25 Promoter	0.006	Copper Sulphate	0.517
AERO® Thiocarbanilide 130	0.188	Screened Lime	1.106
Sodium Cyanide	0.003		
Zinc Sulphate	0.102		
Sodium Silicate	0.068		

At Rio Pallanga lead concentrate grade is deliberately lowered by floating some pyrite in order to get the optimum local smelter rate. To avoid excessive grinding costs (which would be required to liberate finely disseminated sphalerite in the dolomite gangue), somewhat higher-than-average zinc tailings are tolerated. Sodium silicate is used to help depress quartz. Typical mill assays are:

	% Zinc	% Lead	Silver (Oz.)
Heads	5.1	4.1	7.5
Lead Concentrate	6.7	52.6	91.2
Zinc Concentrate	59.1	0.2	3.1
Tails	0.9	0.1	0.8

Whether your tonnage is large or small, whether or not your ore is difficult to beneficiate or your operating condition poses special problems, you can have the benefits of Cyanamid world-wide ore dressing experience and unmatched research background.

A Cyanamid Field Engineer stands ready to work with you to evolve the right combination of Cyanamid Reagents for lowest cost-plus-tails on your mill feed. These extra values are freely offered to both present and potential users of Cyanamid Reagents. A letter to our nearest office will bring prompt response.



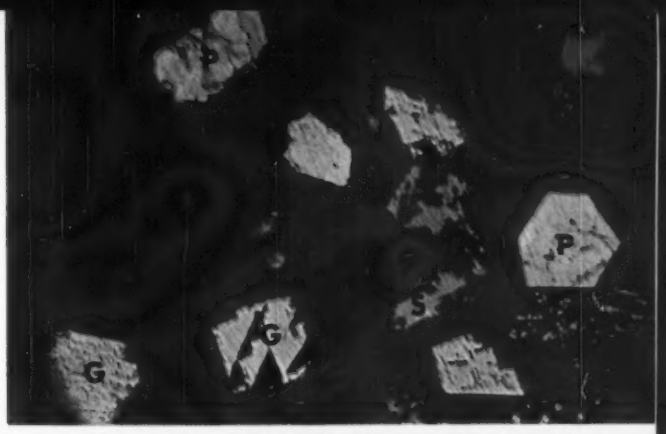
CYANAMID

AMERICAN CYANAMID COMPANY

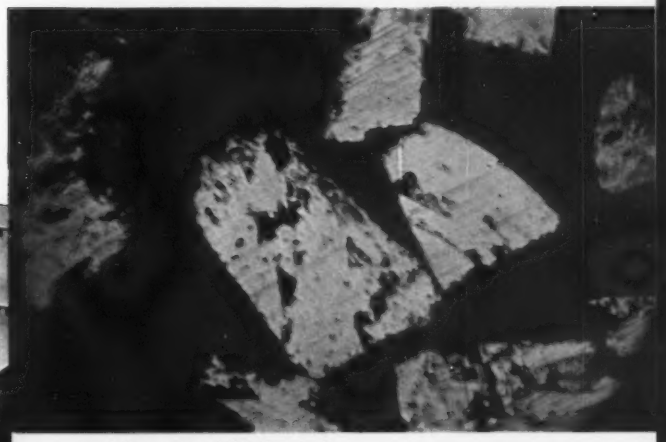
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: Cyanamid, New York

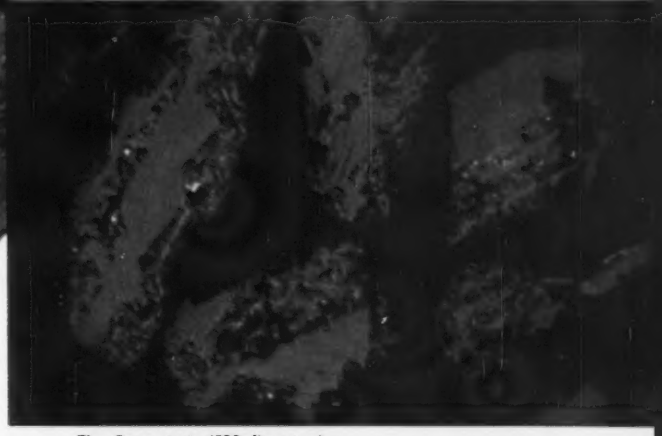
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.



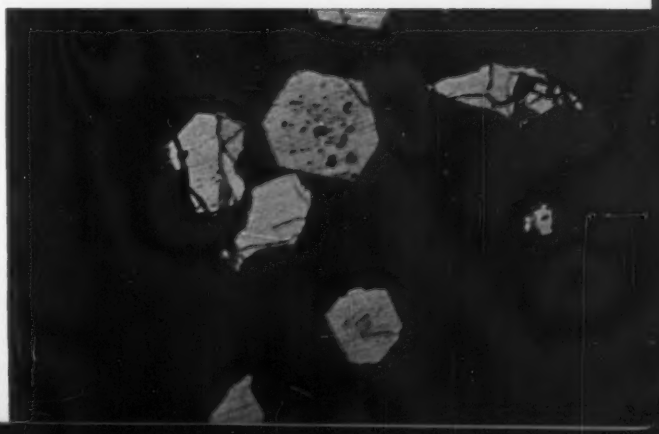
Photomicrographs are all of 100 x 500 mesh fractions of Rio Pallanga mill products. (G = Galena; P = Pyrite; S = Sphalerite.) Above shows mill feed (200 diameters). Dark minerals are calcite quartz and dolomite.



Lead Concentrate (500 diameters)



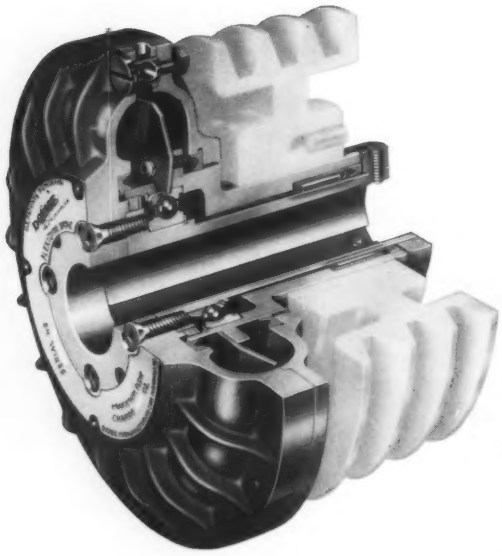
Zinc Concentrate (500 diameters)



Tailings (200 diameters)

WHAT'S YOUR PROBLEM?...

- ☑ Overheated motors?
- ☑ Excessive belt maintenance?
- ☑ Breakage of materials being processed —like thread, wire, paper?
- ☑ Expense of oversize or high torque motors?
- ☑ High demand rate?
- ☑ Expense of reduced voltage starters?
- ☑ Clutch trouble?
- ☑ Breakage of transmission parts due to instantaneous shock loads?
- ☑ Damage and recurring down-time from overloads?



FLEXIDYNE

THE DRY FLUID DRIVE

It is no longer necessary to accept the destructiveness—the costliness—of conventional starting in the mechanical transmission of power. Flexidyne changes that!

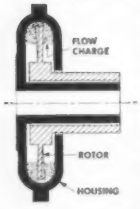
Flexidyne is the new way to start loads *smoothly*—to protect against shock and overload—to save power—all *without any sacrifice of efficiency at full load!*

This revolutionary development is ushering in "the day of the soft start"—which can mean thousands of dollars to you in equipment savings and in better, more economical operation.

Flexidyne is available, off the shelf, in Drives and Couplings. Capacities range from fractional to 1,000 hp. Ask your local Dodge Distributor or write us for technical bulletin.

DODGE MANUFACTURING CORPORATION, 3100 Union St., Mishawaka, Ind.

HOW FLEXIDYNE WORKS



The "dry fluid" in Flexidyne is tiny heat-treated steel shot. A measured amount, called the "flow charge," is contained in the housing, which is keyed to the motor shaft. Inside the housing is a rotor, free to revolve relative to the housing, but connected to the load.

When the motor is started, centrifugal force throws the flow charge to the perimeter of the housing, packing it between the housing and the rotor, which transmits power to the load. Initial slippage is momentary. Housing and rotor become locked together and achieve full load speed without slip and at 100% efficiency.

CALL THE TRANSMISSIONEER — your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

DODGE

of Mishawaka, Ind.

Typical of 71-B applications is this job in a western copper mine. Machine is loading out overburden. Note widespread crawlers which keep the big 71-B steady and stable throughout dig-and-swing cycle.

When you need power YOU GET IT with the 3-yd. Bucyrus-Erie 71-B shovel

The torque converter drive on Bucyrus-Eries gives you cushioned power — automatically balanced speed and torque to meet every load demand.

Engine and main machinery are cushioned against shock loads. The torque converter automatically delivers the right amount of power to meet the minimum and maximum demands of the machinery.

Air controls let you put that power to work smoothly, efficiently. Graduated valves are used on main operating clutches, delivering power *as you need it* — not in a sudden blast.

Where you want action quick you get it. On dipper trip, steering clutches and brakes, and swing brake, poppet type valves are used — full on or off.

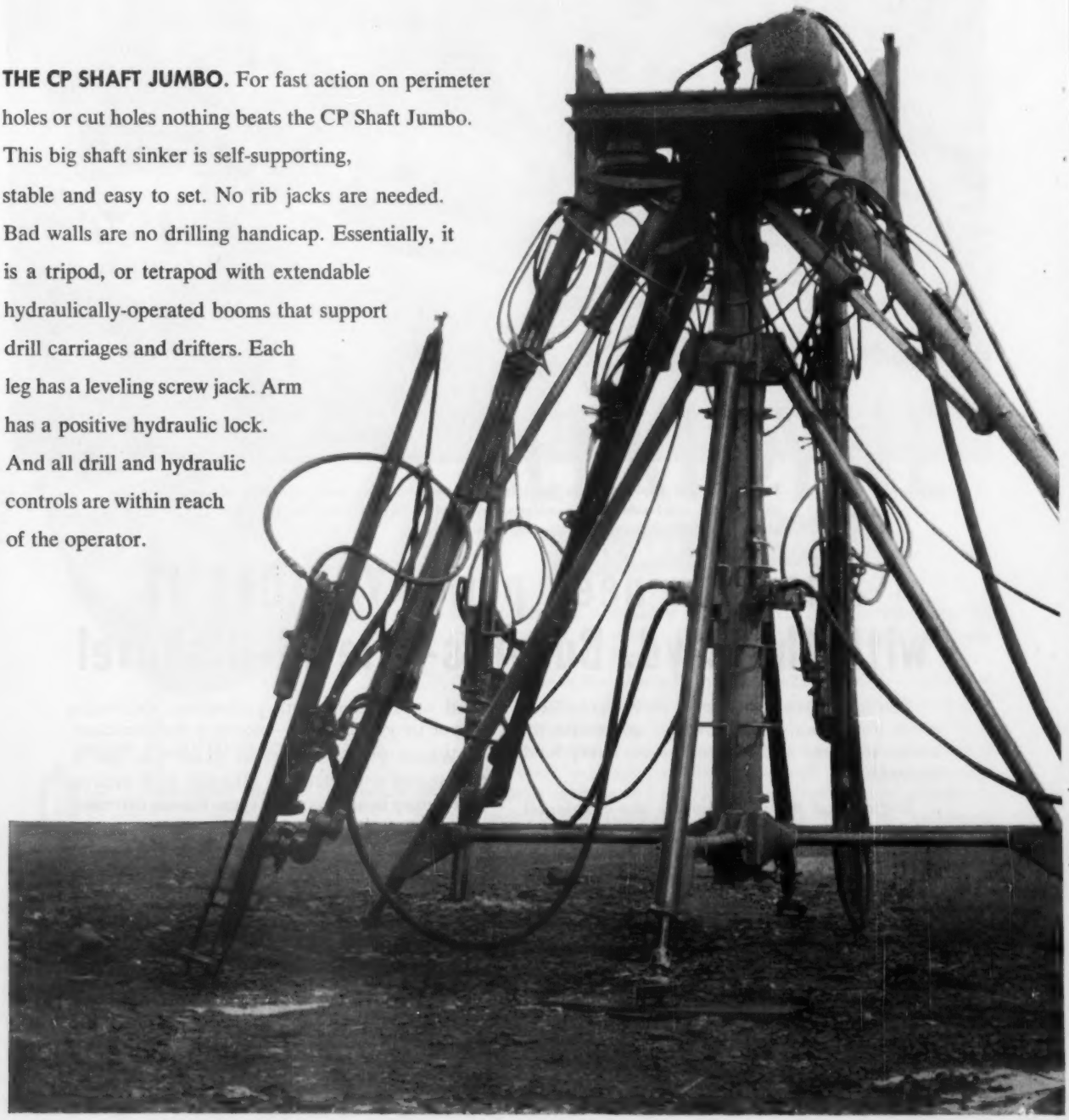
Bucyrus-Erie engineers are specialists in delivering power through machines *job-tested* on every type of job — big and small. Write today and get all the facts about the machine you need. Bucyrus-Erie Company, South Milwaukee, Wisconsin. 548E58

BUCYRUS ERIE

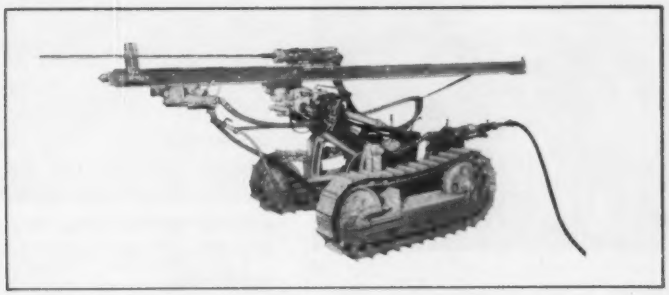
MODERNIZE to economize!

you're always with CP drilling

THE CP SHAFT JUMBO. For fast action on perimeter holes or cut holes nothing beats the CP Shaft Jumbo. This big shaft sinker is self-supporting, stable and easy to set. No rib jacks are needed. Bad walls are no drilling handicap. Essentially, it is a tripod, or tetrapod with extendable hydraulically-operated booms that support drill carriages and drifters. Each leg has a leveling screw jack. Arm has a positive hydraulic lock. And all drill and hydraulic controls are within reach of the operator.



on solid ground equipment



CP TRACDRIL. The new G-800 gives you a 3-way speed-up no matter how tough the terrain: 1. Hydraulic sliding cone gives the carriage added lift for tramming over uneven ground, firmly sets drill carriage stabilizing foot pad on ground. 2. Hydraulic positioner provides proper setting of the drill carriage angle, for left, right, forward and back positions. 3. Hydraulic controls elevate the U-arm with a finger touch, insure quicker drill carriage positioning.

Deep-hole drills available with standard-neutral-reverse rotation types: CP-400DR, 4″ cylinder bore, 2½″ holes to 50 feet; and CP-450DR, 4½″ cylinder bore, 3″ holes to 75 feet.

CP-55 DIAMOND CORE DRILL. *For blast hole and exploratory drilling* – the powerful, lightweight, easy-to-handle CP-55 Diamond Core Drill is faster than any other diamond drill in its class. Has a highly efficient CP Rotary Air Motor . . . requires a minimum of air per foot drilled. Conservatively rated at 500 feet with E Rods and EX Fittings. Skid-mounted types available for test borings . . . capacities to 2250 ft.

Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Questions

We've been asked about the Yieldable Arch

What is the Yieldable Arch?

Bethlehem's Yieldable Arch is made of U-shaped sections rolled from high-strength steel in the 95,000-105,000 psi tensile range. A typical Arch set is built up of three or more segmental lengths which nest at the overlapped ends. Heavy U-bolt clamps hold these ends together, thereby forming friction joints which will yield under excessive pressures. Normally, torque on the bolts is 180-200 ft/lb, allowing Arch to yield at about 40,000-50,000 lb.

Why is the yieldable feature important?

An arch that will yield, such as Bethlehem's Yieldable Arch, gives the overburden a chance to settle slowly into its own natural arch, which then carries the major share of the load. The more the Bethlehem Arch yields, the more the load is transferred to abutments on either side of the opening.

Rigid supports cannot uniformly distribute the dynamic pressures caused by the weight and subsidence of overburden. Sooner or later they "let go," preventing the formation of a natural pressure arch around the mine opening.

In what sizes is the Yieldable Arch available?

Bethlehem rolls two sections of Yieldable Arch: 15 lb and 21 lb per foot. The two sections have almost identical outer contours. The difference lies in the thickness, notably in the top flanges and the base. Sets can be tailor-made to fit mine openings, from a minimum of 6 ft up to 20 ft wide, depending on individual mine conditions.

Where should the Arch be used?

The Yieldable Arch is now being used in both coal and ore mines for haulage roads and drifts, slusher drifts, transfer drifts, or any opening of sufficient size where heavy ground causes spalling or squeezing conditions. This question, of course, can best be resolved by an on-the-spot discussion with a Bethlehem engineer.

What about spacing of Arch sets?

Ground conditions govern the spacing of Yieldable Arch sets, but generally speaking a spacing of 2 to 3 feet in heavy ground is about average. In any situation, the spacing should be such as to ensure that the steel, not the lagging, will do the yielding.

Speaking of lagging, just what is it and why is it important?

Lagging and packing are very important in a Yieldable Arch installation for several reasons. First, to prevent the falling of material into the opening; second, to fill the voids between mine roof and Arch sets; third, to keep the load on the Arches relatively uniform. Lagging can be poles, planks, round or split timbers, or miscellaneous lengths of cut timber. Some mines also use old steel ties and other steel "leftovers."

Does the Yieldable Arch require maintenance?

A Yieldable Arch set is, in the strict sense of the word, a machine. As such, it must be kept operable. If the load becomes evident (as, say, by a sag in the lagging) the Arch must be permitted to yield. U-bolts should be checked for binding; perhaps a blow with a hammer will correct the condition. Torque on the bolts must be properly maintained.

All in all, the Yieldable Arch is a long-service product which will perform satisfactorily with minimum maintenance. When it has outlived its usefulness in a particular location it can be recovered and re-installed elsewhere.

How about cost?

Naturally you'd expect to pay somewhat more initially for a fabricated item like the Yieldable Arch than you would for timbers or other rigid materials. But as soon as the Yieldable Arch is installed, it starts saving you money. Most mine operators who have Arch installations state that the Yieldable Arch pays for itself in remarkably short order; six months is not at all unusual. This, together with salvageability, makes Bethlehem's Yieldable Arch the most economical roof support in heavy ground.

● ***You probably have other questions of a more specific nature to which you would like answers. If so, by all means write us; we will study your questions and reply as promptly as possible.***

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Replaces power shovel with 4-In-1

...gets versatility unlimited!

Digging, 'dozing, clearing, loading—this International Drott TD-9 4-In-1 replaces the limited-duty performance of a ⅜ cu. yd. power shovel. Tony Pacifico Company, Charleston, W. Va., practically builds a 100-ton-per-hour stone-quarrying operation around 4-In-1 versatility. Above, using bulldozer action, the 4-In-1 is removing overburden from a 60-foot-thick rock stratum. Owner formerly had to hire a dozer in addition to the power shovel to clear and strip!

Using a back-drag motion of the clam lip, with high-reaching 4-In-1 clamshell action, the Pacificos do a fast, low-cost job of bank-sloping—to forestall earth slides into the quarry. The exclusive, big-capacity clamshell also gives speedy "stand-and-fill" action of loose materials.

Pushing over a hardwood sapling, the Pacifico 4-In-1 is used for land-clearing ahead of stripping quarry overburden. For uprooting larger trees, a grubber blade can replace the 4-In-1 bucket—to apply the tremendous lifting power of exclusive Drott pry-over-shoe break-out action!

Sticky clay dumps clean—quits gumming the works and slowing overburden removal when the Pacificos use 4-In-1 clamshell bottom dumping. Opening the clam pulls sticky materials from bucket surfaces—gravity pull does the rest, to give the 4-In-1 positive self clean-out!

Prove 4-In-1 four-machine versatility unlimited! Move the machine-selector lever — try the built-in *clamshell, "carry-type" scraper, bulldozer and Skid-Shovel* actions. Compare exclusive pry-over-shoe break-out action for digging hard materials other rigs can't budge! See how exclusive Hydro-Spring swallows shock, protects performance. Ask your International Drott Distributor for a 4-In-1 demonstration.

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®

Send for free catalog today

International Harvester Company
180 North Michigan Ave., Chicago 1, Illinois

Gentlemen:
Please send 4-In-1 catalog literature checked:

☐ 1-yd. TD-6 (CR-640-H) ☐ 1½-yd. TD-9 (CR-627-H) ☐ 2¼-yd. TD-14 (CR-635-H) ☐ 3-yd. TD-18 (CR-632-H)

Name_____

Street or R.F.D._____

City_____ State_____

This is the first of two spillway tunnels being built as part of the $421,000,000 Glen Canyon Dam project at Kanab, Utah. Le Roi H10AL air legs are doing 95% of the drilling on this job.

Water, mud, and grit present a constant problem. Yet, the H10AL air legs are keeping the project on schedule, the superintendent reports.

20 Le Roi H10AL Air Legs cut through 1750 ft. of solid sandstone without a major breakdown

Le Roi Air Legs Conquer Tough Tunnel Job

"Average downtime per machine is only 3 hours per month under the roughest conditions I've ever seen," says tunnel superintendent.

Not one major breakdown — not a single replacement needed since the start of operations in October, 1956. That's the endurance record of the Le Roi H10AL air legs being used to drill water diversion tunnels through solid sandstone.

They've been at it six days a week, averaging 15 ft. a day, under extremely severe operating conditions — and show no signs of letting up, according to the tunnel superintendent. It's rough on men and machines.

Two Giant Tunnels

The job involves the drilling of shot- and roof-bolt holes in two tunnels 2740 and 2900 ft. long for the Glen Canyon Dam on the Colorado River. Each will be 43½ ft. wide at the upper end and 46½ ft. wide at the lower.

Drillers work on a specially-built five-deck jumbo rig, mounted on wheels. Air legs, using 1 in. drill steel, are used on all five levels. Holes are drilled about 18 ft. into the face, at speeds of four minutes per hole.

Tough Going

Actual drilling cycles average four hours per day. But it's tough going every foot of the way. Mud and bad water seepage — 30,000 gallons pumped out daily — make drilling even tougher.

Grit, grime, and water cover everything. The abrasive sand found in the tunnel is equal to 60-grit stone — and gets into everything. Yet, the average replacements on the machines have been springs, seals, bushings, and leather gaskets. Mechanical parts are still intact.

The simple design of the Le Roi air legs has been a real time- and money-saver. "We can tear down and re-assemble a unit in minutes," the superintendent explains. "Average monthly downtime has been 3 hours per machine. Cost of maintenance per machine totals only $20 per month." Like the internal parts, the automatic heads that control the flow of water for drill steel have not required maintenance to date.

"The Le Roi air legs are doing a good job for us in the tunnel," the superintendent added. "They have performed continuously with a minimum of downtime, helping us to keep up with our schedule."

Types Available

Le Roi H10AL air legs are available in single or telescopic types, with 3, 4, 5, or 6 ft. feeds. Your operators will find them easy to handle in roof-bolting, stoping, drifting, or sinking operations. See them at your Le Roi distributor, or write the Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

AT-733

WABCO

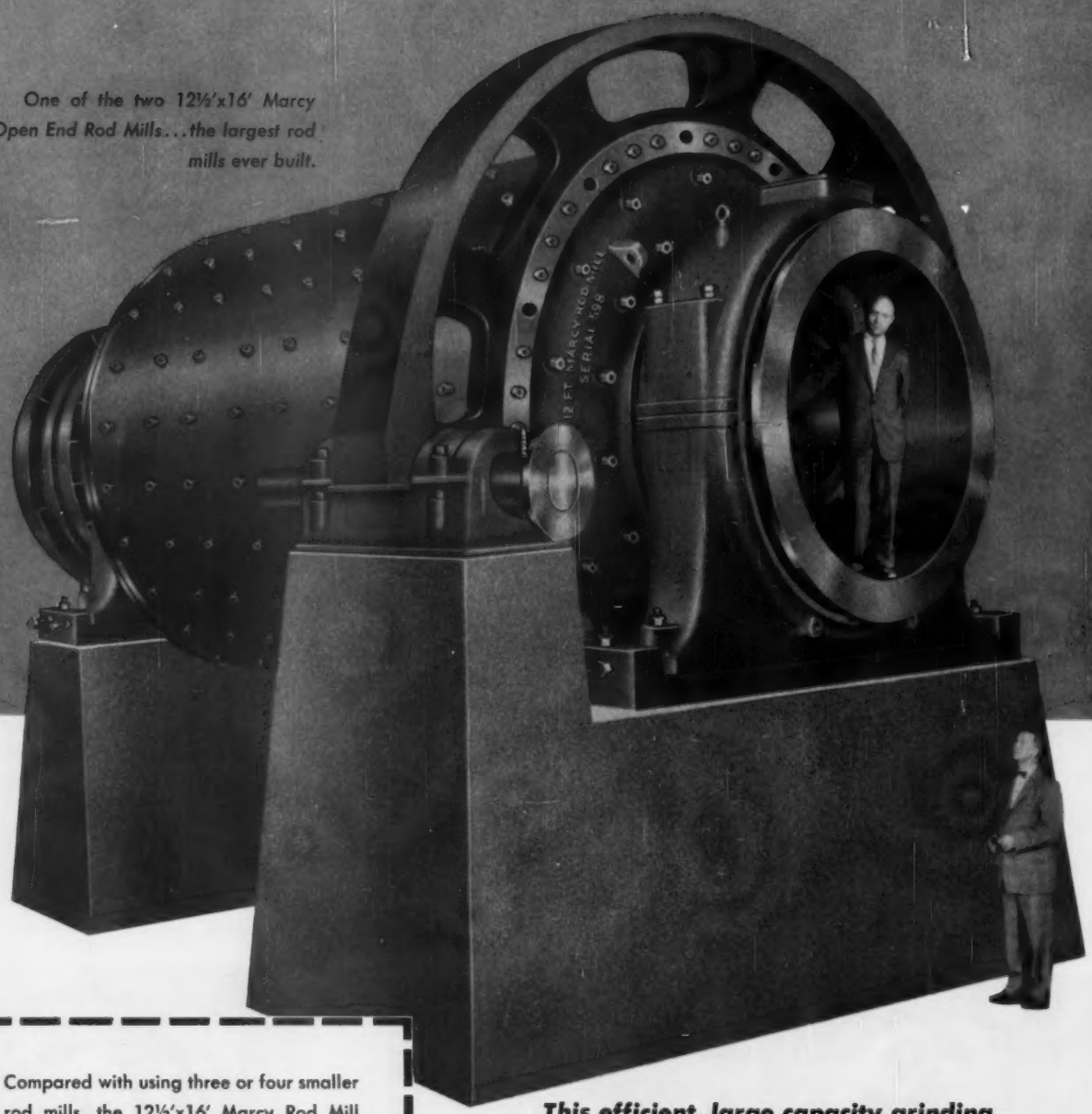
LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Newmatic air tools, Tractair®, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

Specially-built jumbo rig holds 35 men and 16 air legs. When holes are drilled and charges set, the massive wheel-mounted rig is pulled away.

Le Roi air legs are versatile. View shows them being used for drilling and roof-bolting. Bolt holes are sunk on 4 ft. centers. Men are on top level of rig.

Three-man crews operate two air legs. The Le Roi H10AL air legs are easy to handle, making them ideal for operation in close quarters.

How 12½'x16' Marcy Rod Mills



One of the two 12½'x16' Marcy Open End Rod Mills...the largest rod mills ever built.

Compared with using three or four smaller rod mills, the 12½'x16' Marcy Rod Mill offered the following advantages...

- **Lower initial cost**
- **Less floor space**
- **More efficient grinding**
- **Less power per ton**
- **Lower labor costs**

This efficient, large capacity grinding is made possible by...

- Mine and Smelter's specialized experience in the design and manufacture of grinding mills, and
- The Marcy principle of grinding..."rapid change of mill content is necessary for high efficiency," which is accomplished by the open end feature in Marcy Rod Mills.

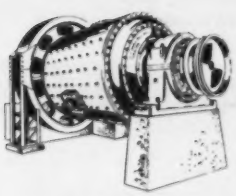
For consultation on your grinding problems contact Mine and Smelter's grinding engineers.

Solve Milling Problem, Reduce Costs

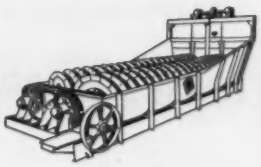
An Arizona copper company, planning a new mill, wanted to grind 12,000 tons per day. To handle this capacity would require three or four mills, based on mill sizes available at that time.

Mine and Smelter, in cooperation with this copper company and its consulting engineers, proposed 12½′ x 16′ Marcy Open End Rod Mills... the largest ever built... each mill to have a capacity of 6,000 tons per 24 hours grinding from ¾″ to approximately 10 mesh.

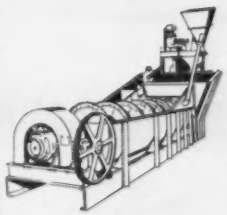
Other Products for the Mining Industry



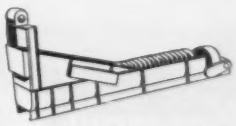
Marcy Grate Discharge Ball Mills



Akins Classifiers



Akins HMS Separators



Akins Densifiers

Skinner Roasters and Dryers

Massco-Grigsby Rubber Pinch Valves • Wilfley Tables • Marcy Pulp Density Scales • Laboratory Crushers and Pulverizers • Esperanza Drag Classifiers • Scrubbers • Pug Mills • Burt Filters • Fusion Furnaces • Leaching Drums

Manufacturing Division

THE MINE AND SMELTER SUPPLY CO.

DENVER 16
3800 RACE STREET

NEW YORK 17
122 E. 42nd STREET

SALT LAKE CITY 1
121 W. 2nd S.

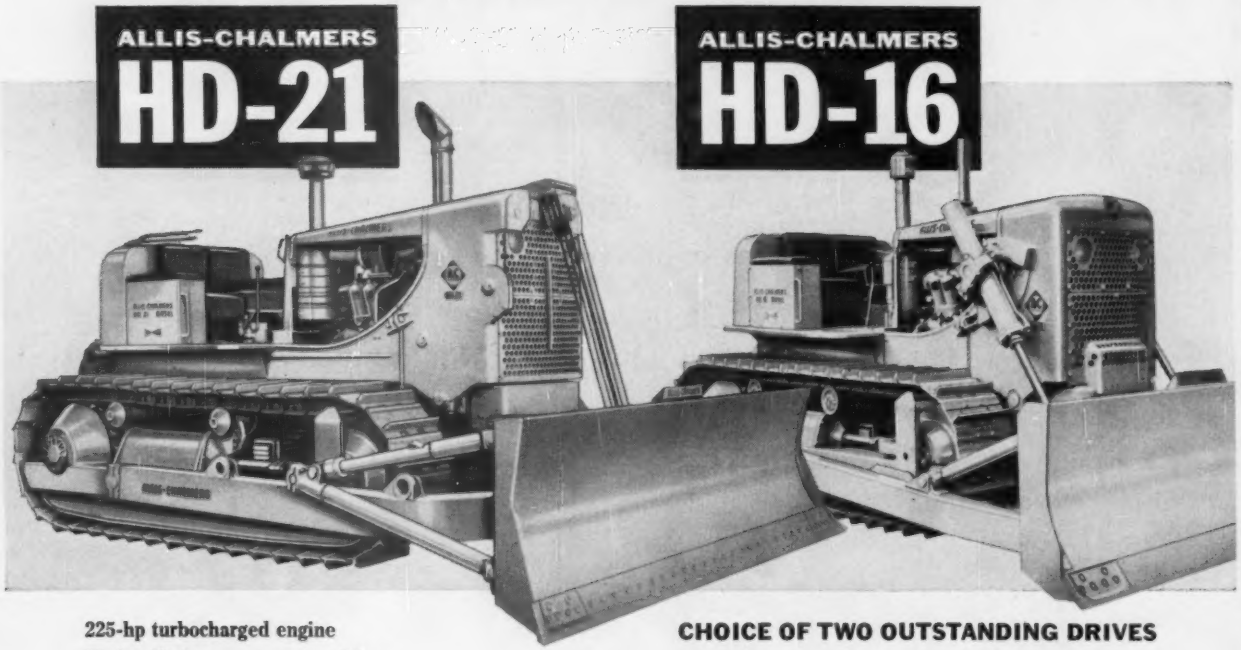
EL PASO
P.O. BOX 1162

LICENSED MANUFACTURERS AND SALES AGENTS in Canada, Australia, Sweden, England and South Africa.

SALES AGENTS in Peru, Chile, Philippine Islands, Japan, New York City (for Continental Europe) and in principal cities of the United States.

ALLIS-CHALMERS CRAWLER TRACTORS . . .

first choice on more and



225-hp turbocharged engine
Hydraulic torque converter drive
56,260 lb (approx. as shown)

The new HD-21 brings you live power for today's big-tractor jobs—and torque converter drive puts it to work automatically. The HD-21 offers more work capacity—dollar for dollar—than any other big crawler tractor you can buy.
HD-21A illustrated—Two other models available

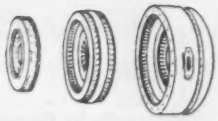
CHOICE OF TWO OUTSTANDING DRIVES

Hydraulic torque converter	All-gear drive
150 net engine hp	141 belt hp
39,090 lb (approx. as shown)	125 drawbar hp

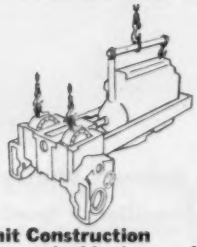
Get up on the HD-16 yourself—and see how it handles jobs ordinarily assigned only to bigger, more expensive crawler tractors. You'll sell yourself—just as more keen-eyed construction men do every day.
HD-16DC illustrated—Five other models available

THE ONLY COMPLETE LINE OF CRAWLER TRACTORS

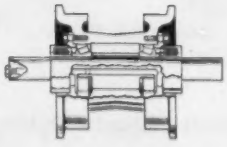
Pioneered and proved by Allis-Chalmers Engineering in Action



Torque Converter Drive gets more work done—automatically provides the right pull or push for every load, at maximum speed for existing conditions. *(Available in HD-21 and HD-16 only.)*



Unit Construction saves valuable time . . . lets you remove any major assembly without disturbing adjacent assemblies.



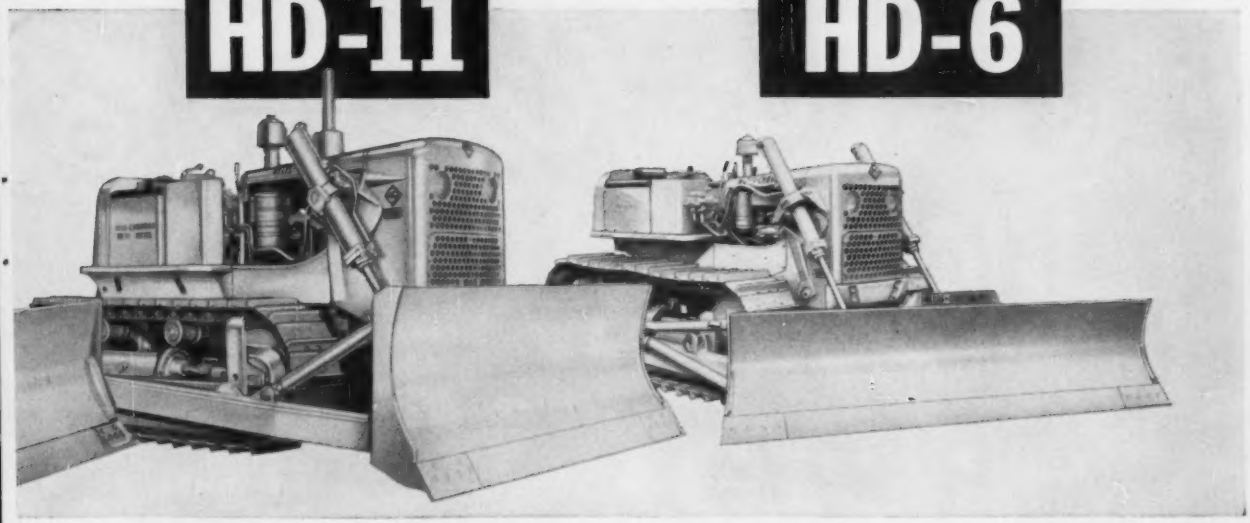
1,000-Hour Lubrication intervals for truck wheels, idlers, support rollers . . . changes daily greasing time into production time.

Look ahead...*move ahead*...and stay ahead

more tough jobs

ALLIS-CHALMERS HD-11

ALLIS-CHALMERS HD-6



94 belt hp

25,960 lb (approx. as shown)

The HD-11 is setting new standards in its size range . . . offers you dozens of work-boosting advantages, including the industry's easiest shift pattern. A single shift takes it from any forward speed to any reverse—gets short-cycle jobs done faster, easier.

HD-11B illustrated—Two other models available

63 belt hp

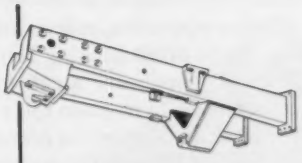
16,470 lb (approx. as shown)

Here's up to 15,500 lb drawbar pull. The HD-6 is the only tractor near its size with big-tractor design advantages—for example, All-Steel Box-A main frame and engine-mounted dozer with direct-lift cylinders for improved weight distribution, accurate dozing and long life.

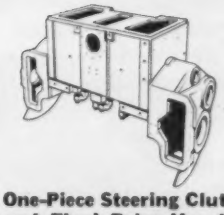
HD-6E illustrated—Three other models available

THAT GIVES YOU ALL THESE ADVANTAGES IN EVERY SIZE

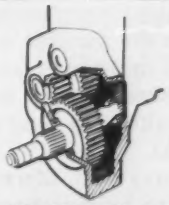
True-Dimension Track heat-treated and machined in the industry's most modern facilities, is setting new track-life records on every type of work.



All-Steel Box-A Main Frame soaks up shock and strain . . . provides improved weight distribution and equipment mounting.



One-Piece Steering Clutch and Final Drive Housing with extreme rigidity and strength . . . line-bored to provide precise alignment of gears and shafts.



Straddle Mounting of All Final Drive Gears with tapered roller bearings on both sides of short, large-diameter shafts . . . provides extra gear life.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

with ALLIS-CHALMERS

22½-ton Mack LVX

SURE WAY TO TURN A PROFIT

From the moment you start hauling ore on Macks, you'll find what mine operators the world over have discovered—that, for the utmost in economical operation and long service life, you can't beat a Mack!

Heavy-duty Mack dumpers are engineered from start to finish to handle the most punishing hauling jobs. Single-unit all welded frames that pay dividends in extra years of service and rock-bottom down time . . . outstanding economy that cuts hauling costs to the bone . . . and unmatched performance and durability that mean Macks are hauling more profit-making payloads, month after month, with time out for only routine servicing.

You get other important advantages from Mack: exclusive Mack Balanced Bogie with Power Divider, that takes you in—*and* out—of places where other trucks just can't go . . . Mack-built clutches, transmissions and differentials specially engineered to work together for the best possible performance.

Mining operators everywhere are benefiting from these Mack profit-making features. Give your Mack branch or distributor a call for the names of Mack users near you. Let them tell you about the "extras" they get from Macks—in economy, performance and long service life—that can mean a more profitable operation for you. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

6392

MACK
first name for
TRUCKS

30-ton Mack LRSW

34-ton Mack LRVSW

15-ton Mack LRX

Powerful Chemicals Unlock Earth's Treasures

Wrenching metal from nature's stubborn grasp has always been a tough, tedious job—a job for powerful men and powerful equipment. And it's becoming more and more a job for powerful chemicals such as those discussed below. Chemicals are frequently on the mining newsfront these days because the new ones are doing the recovery job better, faster and at lower cost. Up-to-date information on several Dow mining chemicals is presented below in capsule form for metallurgists who must keep well informed.

You may wish to check certain items in this advertisement and forward to those concerned in your company.

ROUTE TO:

_____

_____

_____

_____

_____

_____

SPEEDY FLOCCULANTS SOLVE MANY SETTLING PROBLEMS

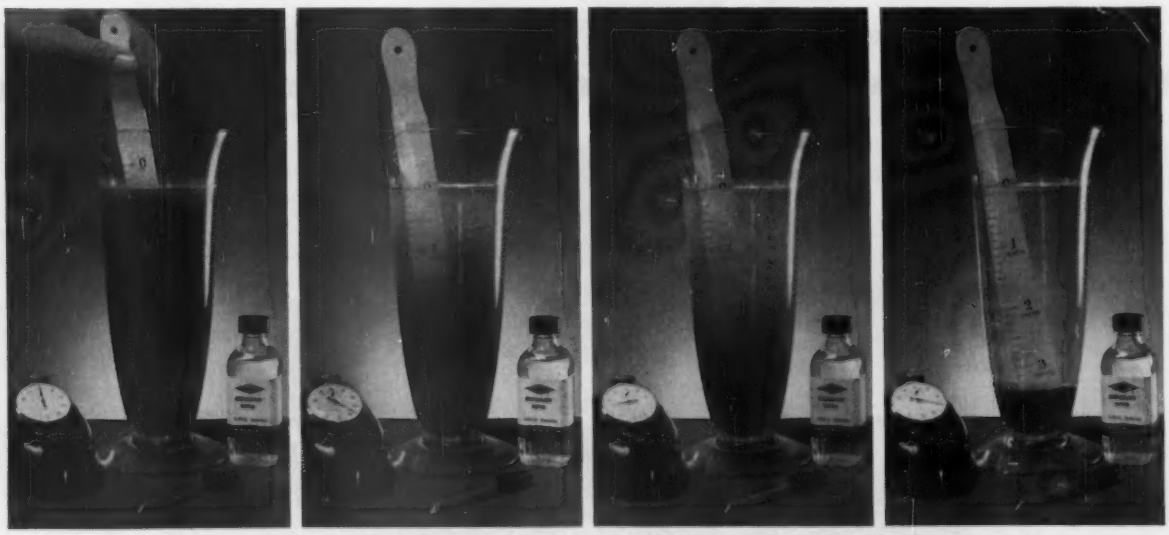
Separan® NP10 and Separan NP20 are pushing ahead on the trail blazed by Separan 2610. They offer money-saving opportunities for metallurgists faced with difficult liquid-solid separation problems.

As a man once said, there are two kinds of apple pie: good apple pie and better apple pie. Such is the case with these two new Separan products.

Separan NP10 is a high power, efficient flocculant while Separan NP20 is the most powerful flocculating material available. Both can now be obtained in commercial quantities for use anywhere in the mining world—from Alaska to Madagascar.

Dow mining technical service men, with their average of sixteen years experience in the mining field, are already working with processors in using the improved Separan products in their operations. Present users of Separan 2610 are advised that laboratory evaluation of Separan NP10 is not necessary. It is an improved form of Separan 2610. In the case of NP20, however, Dow recommends product evaluation because of its increased effectiveness in many operations.

What Separan flocculants will do. To many metallurgists in companies around the globe, Separan is well-known as an old friend. These unique polyacrylamide-type flocculants work with startling speed. This characteristic



Coal solids completely settled in 3 minutes, 20 seconds by addition of Separan NP10, followed by gentle agitation. (Solids content: 5% by weight.)

helps step up throughput without extra equipment! Separan flocculants have aided many companies in decreasing material losses, increasing product recovery, decreasing required thickener and filter area and reducing waste disposal problems. They are effective over a wide pH range.

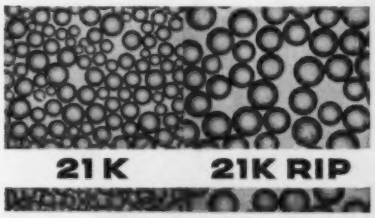
More family members. Separan NP10 and NP20 form the nucleus of a broad line of Separan products now under development in Dow laboratories. This flocculant "family" is providing specialized recovery and separating agents for a number of highly diversified mining applications.

ION EXCHANGE:

"worth its weight in uranium"

New processing ideas are always welcome, but one that works as well as ion exchange in the uranium industry is "worth its weight in uranium".

One of the prime reasons for the achievement of wide experience by



Two new Dowex resins developed for the mining industry.

Dow technical men has been the success of ion exchange principles in the uranium industry. They are applying these principles to many phases of modern industry. Not only are these men experienced but the products they have developed are the finest available.

Dowex resins. The trademark under which Dow markets its ion exchange resins is Dowex®. Several different types of Dowex resins are available for use with specific ores. Dowex 21K and Dowex 21K RIP are two of the most popular. If your recovery is not as great as you think it should be, ion exchange resins might hold the key to more efficient processing. Your inquiries are invited by a skilled ion exchange technical team.

*TRADEMARK OF THE DOW CHEMICAL COMPANY

★ ★ ★ ★

For more information on any of the chemicals discussed in this advertisement write THE DOW CHEMICAL COMPANY, Midland, Michigan, Chemicals Sales Department 766J.

SOLVENT EXTRACTANTS:

new process expanding rapidly

Among hydrometallurgical recovery methods on the Colorado Plateau, solvent extraction is one of the most popular. The main reasons this method is finding favor with uranium processors are its ability to treat a wide variety of ores, its excellent recovery record, and the fact that reagent costs are low.

Tailored for uranium. Dow's two extractants, Dowsol* 12 and Dowsol 17, are also meeting with enthusiastic reception on the Plateau. Both were developed specifically for use with uranium and can also be used to recover thorium, vanadium and several quadrivalent metals. Both are supplied as a 25-30% solution of monododecylphosphoric acid (DDPA) dispersed in a kerosene carrier. Before Dowsol is put to work, the processor further dilutes the solvent with kerosene to a concentration of 2.5% alkyl ester.

When the solvents are contacted with a solution containing metal values, the values are transferred from the solution to the solvent. The barren solution and loaded solvent resulting from such contact are separated via specific gravity differences. After separation, the solvent is stripped of metal values by contact with strip solutions and reused.

Efficiency vs. economy. These versatile solvents have a very low solubility in aqueous solutions, slurries and pulps. Dowsol 17 has lower solubility than Dowsol 12 and is less selective for iron in the ferric state. And its phase disengagement time is more rapid. These two solvent extractants are the first of a growing group of Dow products for specific separation problems. Research and development work is now in progress to provide the mining industry with a wide selection of solvents.

on the MINING CHEMICAL NEWSFRONT

Dowfroth® 250—Powerful, durable frother proves easy to regulate. Write today for new edition of "Flotation Fundamentals."

Chelating Agents—New Texas facilities assure abundant and favorably priced supplies of Versene® 100, other Dow chelating agents.

Muriatic Acid—On land or water, Dow ships HCL when and where you want it from eight terminals. First to ship bulk by sea.

Caustic Soda—86-page caustic soda handbook puts a wealth of NaOH information in compact, usable form. Write for this handy reference now.

Dow Chemicals Basic to the Mining Industry

Flocculants • Ion Exchange Resins • Preservatives • Chelating Agents
Ammonia • Solvent Extractants • HCL • Frothers • Chlorine
Calcium Chloride • Alkalies • Flotation Agents

YOU CAN DEPEND ON DOW

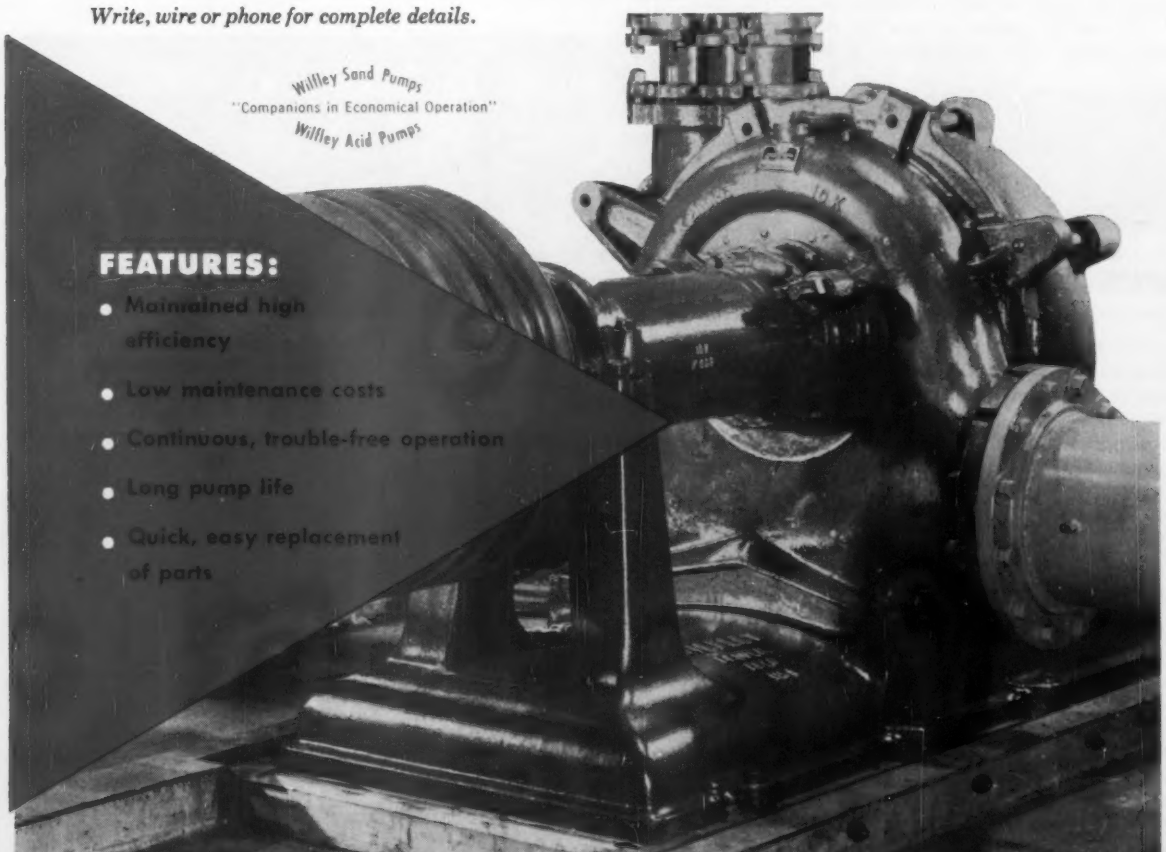
NEW! WILFLEY

10" Sand Pump for Higher Tonnages

Now, to meet the increasing demand for higher tonnages, Wilfley introduces a new 10" slurry pump! This addition to the famous Wilfley Model "K" pump line will be available with a variety of abrasion-resistant alloys and interchangeable, soft rubber-covered wear parts. The economical operating features of all Wilfley Sand Pumps are built into this new model. *Individual Engineering on Every Application*

Write, wire or phone for complete details.

Wilfley Sand Pumps
"Companions in Economical Operation"
Wilfley Acid Pumps



FEATURES:

- Maintained high efficiency
- Low maintenance costs
- Continuous, trouble-free operation
- Long pump life
- Quick, easy replacement of parts

When you buy quality, Wilfley quality, you buy superior performance.

A. R. WILFLEY and SONS, INC.

DENVER, COLORADO, U. S. A. • P. O. BOX 2330 • NEW YORK OFFICE: 122 EAST 42ND STREET, NEW YORK CITY 17

ENGINEERING AND MINING JOURNAL

OCTOBER, 1958

A New Type of Competition

"WE VALUE TRADE least for economic reasons and most for political purposes." This statement is attributed to Khrushchev in a recent report on "World Trade and the Aluminum Industry," which outlines the impact of Soviet economic warfare on the aluminum industry as follows:

"The Soviet Union is using aluminum exports in its economic offensive against the Free World. During 1957 and early 1958, by attacking the British price, with perhaps no more than 20,000 tons of aluminum, Russia forced a two-cent-per-pound cut in world markets, affecting 3-million tons of annual Free World production. Soviet export aluminum prices seem to be 60% less than Soviet domestic prices, 21.2c in Britain as against 53.5c in the Soviet Union. Only economic warfare seems to explain this dumping action because Russia made no offer to unload large surpluses or to obtain maximum amount of foreign exchange. The danger to United States markets is indirect, but nevertheless serious. Dump-priced Soviet aluminum is being used in Belgian, German, British and Austrian mills to fabricate sheet, rod and foil which then come into United States markets with the benefit of reciprocal trade agreements. The low wage levels in these mills and the low price of Russian metal enable them to cut 20% or more below United States prices. Unified Free World action is essential to combat Soviet economic warfare.

"Western European embargoes and anti-dumping action is unlikely. The defense against Soviet economic warfare probably lies in the direction of putting to use all aluminum offered in Free World markets, regardless of source."

What has happened to aluminum has also happened to platinum.

Already the tin price has collapsed. The International Tin Agreement, forced during recent months to buy Russian-sponsored (Red China?) tin in an effort to maintain price, faltered in the middle of September. The Council announced that it would no longer be able to support the market; tin would have to seek its own level. Although unannounced, experts felt that the pool manager had run out of money. Continued non-support could ruin Free World tin producers.

With substantial mineral reserves, cheap forced labor, and complete and absolute control over price, production, exports and consumption, the Soviet Union is armed with an economic weapon that completely baffles the defenses of mineral producers in the Free World. Domestic mineral producers are practically in a strait-jacket. They are saddled with high state and federal taxes; bound to comply with high wage demands of powerful unions; often the victims of one-way reciprocal trade agreements; and so badly intimidated by anti-trust laws that they even fear to discuss in public the basic laws of supply and demand which affect price and the economic security of marginal producers.

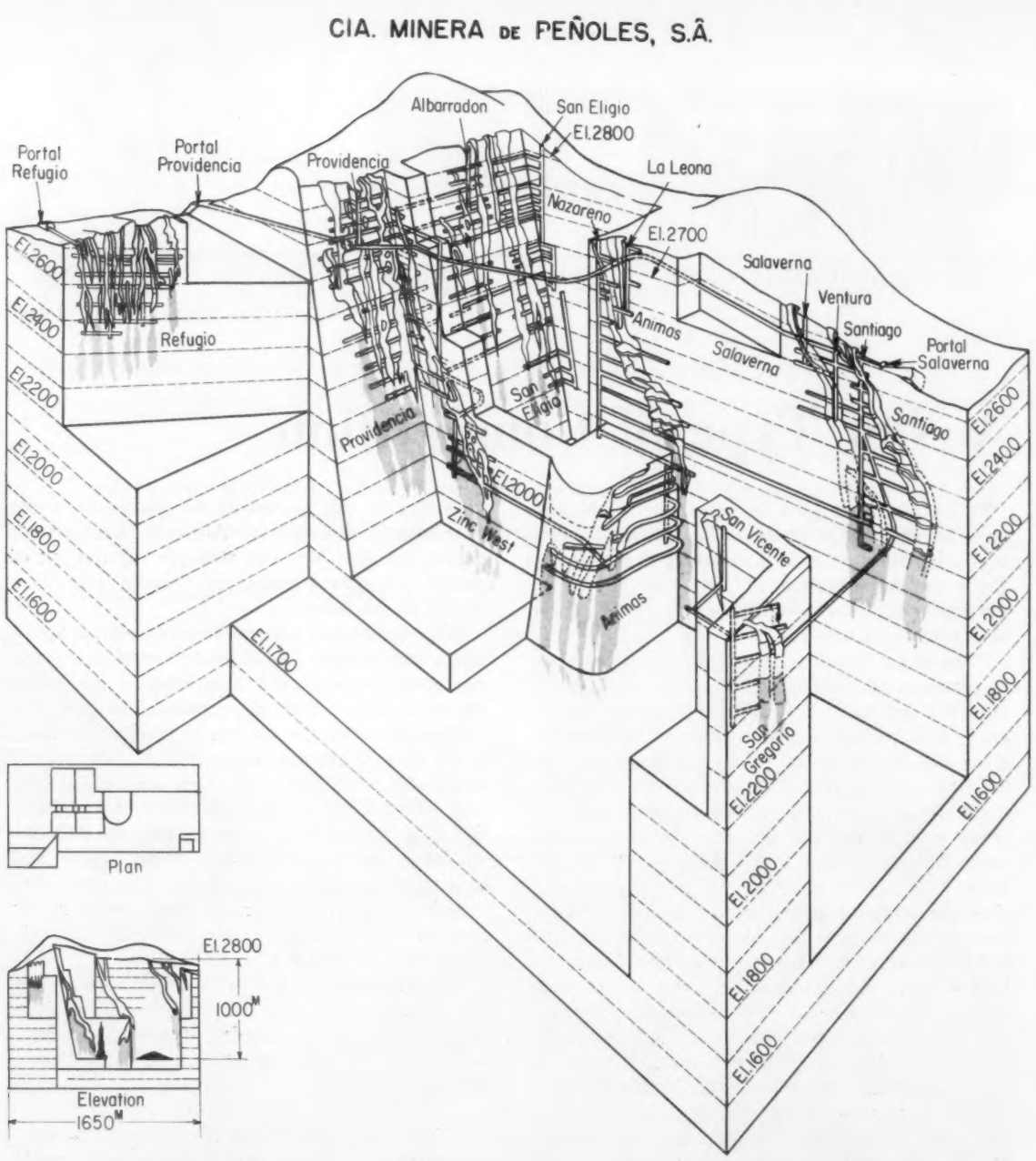
Certain aspects of the new Soviet economic offensive almost dictate that this new threat be given high priority on the agendas of mining meetings, legislatures, the State Department, and the United Nations. These are:

1. The Soviet Union regards economic warfare as a perfectly legitimate way of furthering its world political aims.

2. Without Government aid and protection, private industry will be powerless to combat the new threat.

3. If pursued, the Soviet offensive will first attack mineral producers with the most effective weapon—sub-economic prices. Then, when production has been critically curtailed, the economic guns will be trained on the consumers.

4. There is little reason to believe that the economic attack on platinum, aluminum and tin markets will not be extended to copper, lead, zinc and other metals in the future.



A Second Tunnel Is Being Driven at 2,000 Meters to Save a Mine

TO MINE the "fingers" of ore which remain at the Avalos Unit of Compania Minera de Peñoles, the American Metal Climax subsidiary is driving a 4-mile haulage tunnel at the 2,000-meter level of the lead-zinc-silver preperty.

Another tunnel, at the 2700 level, was constructed in 1946.

The low-grade fingers could not be mined economically under the former system of hauling to the top of the mountain in Zacatecas District, Mexico. Now, with the new tunnel, and with the recent discovery of another low grade orebody, Peñoles has extended its life and plans an increase in tonnage from 13,000 metric tons per year to 200,000. Other improvements and changes will add to the economy of the new plan.

Construction of the new tunnel is a joint effort of Peñoles' own mining staff and an outside contractor. The tunnel is expected to be in operation by 1959, at which time the aerial tramways that have served the various shafts of the mine will be eliminated.

A total of 33 shafts served the deposit at one time, and 8 are still in use by Peñoles. During its earlier history, the mountain was mined by Peñoles, Cia. Minera Nazareno y Catasillas, Mazapil Copper Co., and American Smelting & Refining Co. (copper-lead-zinc producer).

Peñoles consolidated the whole operation in the mid-1930's and now, with the cooperation of the Mexican government's tax department, is extending the life of the unit with the new tunnel. Both production and export taxes have been reduced as an encouragement to the mine management to keep the property alive and working.

In the drawing above, the shaded areas represent unmined reserves. In the elevation, the artist has placed silhouettes of New York's Empire State Building and Mexico's Pyramid del Sol for comparison with the mine's depth.

New Four-Mile Tunnel Adds New Life To Peñoles' Avalos Lead-Zinc Mine

CIA. MINERA DE PENOLES, S. A., Mexican subsidiary of American Metal Climax Inc., is extending the life of its Avalos Unit, Zacatecas, through a modern $1.5-million project which includes the driving of a haulage tunnel nearly four miles long.

When the tunnel goes into operation, by the end of 1959, it will usher in a third stage of operations at Avalos, designed to permit economic extraction of low-grade orebodies. These orebodies consist mainly of the scattered roots of concentrations already mined.

In essence, the tunnel's purpose is to extend the life of the Avalos Unit by affording a mill-level exit for ores. The practice since 1936 has been to hoist mined ores and pump ground water to a mountain-top installation called Providencia, 8,692 ft above sea level. After primary crushing at Providencia, the ore has been lowered by a 3.75-mile aerial tramway to the mill at Terminal, 5,576 ft above sea level. As workings became deeper, and led only to orebodies of decreasing richness, extraction costs soared. A point was reached which made present methods of operations uneconomic, particularly since the main Avalos ores are lead and zinc.

The idea of the haulage tunnel arose as a solution. But even at the higher lead and zinc prices then prevailing, the tunnel appeared to be prohibitively expensive. Peñoles took its problem to the Mexican government, who responded by granting Peñoles special reductions in production and export taxes, thereby making the project possible.

The Avalos Unit is located in the prolongation of the Concepcion del Oro Mountain in Mazapil District of the State of Zacatecas. Mining in the district may be traced back some 400 years. Until 1905, during what may be termed the first phase, high-grade gold-silver-lead oxidized ores were mined down to a depth of 984 ft. From 1905, when formal exploitation of the mines was begun, until 1935, several companies, side by side, worked the enriched oxide zones. Prominent workings included the Providencia, Ozuna and Albarradon mines, belonging to Peñoles; the Santiago and Catasillas mines of the Cia. Minera Nazareno y Catasillas; the Salaverna, La Leona, San Eligio and San Vicente mines of the Mazapil

FROM THE HILL where high grade lead-zinc-silver ore has been mined for decades, Cia. Minera Peñoles will haul ore via its new 4-mile tunnel to the plant at Terminal. New shops and maintenance facilities will also be constructed.

TO THE MILL. Passageway in the foreground is the planned trackbed for the rail link from the Salaverna shaft. Aerial tramway (left) which formerly brought ore from the top of the mountain will be eliminated when the tunnel begins haulage.

CONTRACTOR'S LOCOMOTIVE takes rock from the portal end of the tunnel. Outside firm was employed to drive a minimum of 3.1 miles of the final haulage facility.

PENOLES' MINERS are working from the mine end of the tunnel, using standard underground equipment and methods. The miners average about 131 ft per month.

Averages for Month of March 1958

Advance per blast	2.10 meters
Holes per round	30
Kg dynamite per cubic meter	2.41
Cycle time	3.38 hours
No. blasts per 24 hr	7
Time:	
Drilling	63 minutes
Loading	25 minutes
Ventilating	9 minutes
Mucking	73 minutes
Change	48 minutes
Average cycle time	3 hr. 38 min.

Gelamex (DuPont) 60%

Four-hole V cut
Timken insert Type H
1¼ in. round drill steel

18 men on advance crew
12 men on service crews } per shift

Copper Co., and the Refugio, La Providencia and San Gregorio mines of the American Smelting & Refining Co. Each operator used an aerial tramway to transport ores from the mountaintop workings to where they could be handled by mine cars or wagons.

As workings deepened and enriched silver-lead oxide sections of the orebodies became depleted, the second phase of operations was initiated. In the mid-1930's, Peñoles was successful in the consolidating of operations through royalty and participation contracts with other companies operating in that area. During this second phase, the higher grade sulphides were exploited. But mining was difficult and costly. Some 33 hoisting shafts were required in the mining and draining of the various orebodies, eight of which are still in use. In 1946, a 1.225-mile tunnel was completed, linking the Providencia installation with the operations at Salaverna on the opposite mountain slope.

Approximately 3-million metric tons of ore were mined and milled between 1936 and 1956. With depth, the grade of the orebodies not only dropped off, but generally tended to become smaller or to branch into smaller segments or roots. In some cases, it was necessary to hoist and pump as far as 2,460 ft. The unfortunate ratio of rising costs versus lowering returns forced the shutting down of several orebodies.

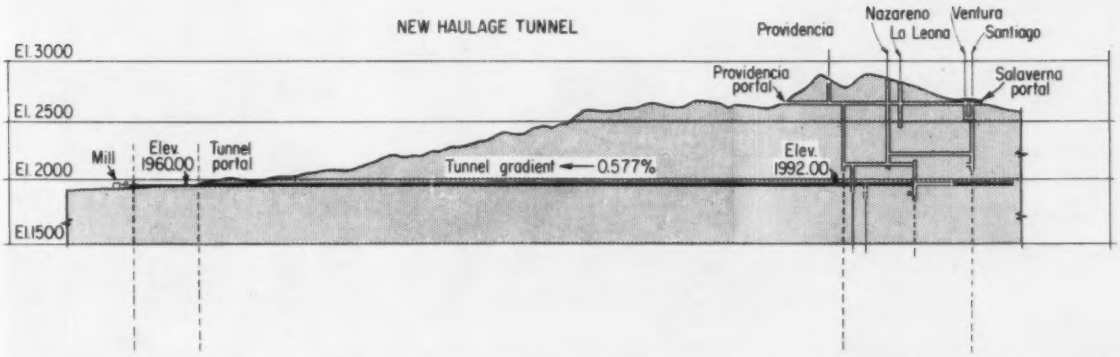
The declining situation at Avalos was particularly important for Peñoles, which depends on Avalos for some 50% of its company-mined ores and for 25% to 30% of the intake at the Peñoles smelter at Torreón and the company's refinery at Monterrey, where Peñoles' central offices are located. Thus, although the current project was viewed as a risk, this was preferable to the alternative shutting down the Avalos Unit completely. In addition to the tunnel, the project includes:

(1) Consolidation of all shops, offices, warehouses, etc. at Terminal, thereby eliminating duplication in other camps. The aerial tramway will be eliminated. Installations at Providencia will be reestablished at Terminal near the mill. The miners' housing at Salaverna camp probably will be continued.

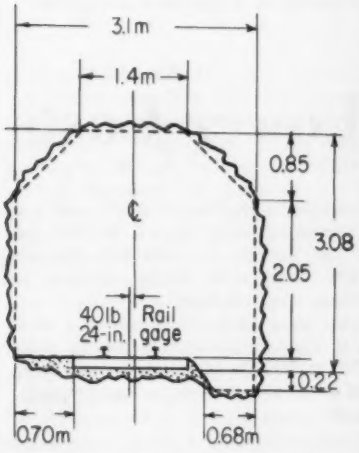
(2) Establishment underground at tunnel level of an area for storage of materials and supplies and a small light maintenance shop as well as a central gathering point for mine cars. Also, underground location of compressors in place of Providencia and Salaverna.

(3) Broadening of the gage of the company-owned railroad track between Terminal and the Coahuila & Zacatecas R.R. at Avalos, Zacatecas which connects with the national railroad at Saltillo, Coahuila. This will permit C&Z locomotives to run directly to the Terminal mill.

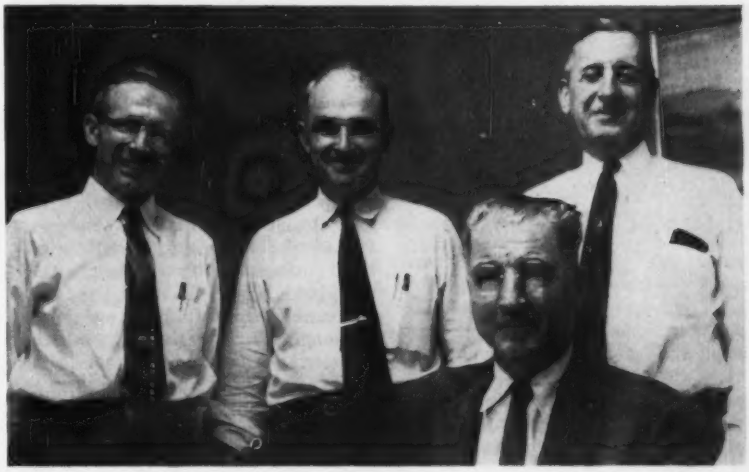
Planning at Avalos Involved Careful Engineering and Teamwork



A CONSTANT GRADIENT of 0.577%, favoring the load, will be maintained in the tunnel. Shops, offices, etc. will be consolidated at Terminal and underground mine car spotting storage and maintenance sites placed at the tunnel level.



ENGINEERING of the tunnel included provision for saving much needed water.



GENERAL MANAGER M. C. Haas (seated right) is assisted by superintendent C. T. Williams, chief mining engineer J. B. Malcolm, and assistant manager H. A. Tanner.

For driving a minimum of 3.125 miles of the 3.84-mile tunnel, Peñoles contracted Constructora El Aguila, S. A., Mexico City. Since beginning to blast last Oct. 24, El Aguila has been averaging 900 ft a month for the first six months. Meanwhile, from the opposite face, Peñoles has been driving with regular mine development methods and equipment, averaging about 131 ft a month. Great care is being taken at both faces to maintain the .577% gradient in favor of the load. The tunnel will pass for two-thirds of its length through a monzonite mass, the remainder of the rock being shale and limestone. It is expected that less than 10% of the rock will have to be timbered although little is known of the limestone-monzonite contact areas and flows of water could be encountered.

The tunnel is 10.1 ft high by 10.17 ft wide and has a drainage ditch 30.7 in. wide by 8.66 in. deep. The drainage ditch is adequate to contain a flow of about 800 gpm of water. Since the Avalos Unit is in a dry area, drainage water will be conserved for mine-mill operations.

Without the tunnel, Peñoles estimated its reserves at about half a million tons of 5% to 14% lead-zinc ores. Peñoles figures that the tunnel will add another million tons of 2.2% lead and 8.7% zinc ores. The company has gained a "bonus" through the recent discovery of additional tonnages of low-grade ore. Moreover, the tunnel and the consolidation of facilities are expected to lower operating costs some 30%. Thus, the life of the Avalos Unit is being extended a foreseeable 8 to 10 years, despite the fact that production will be stepped up from 13,000 metric tons annually to 200,000 metric tons when the new tunnel is opened.

M.C. Haas, general manager of both Cia. Minera de Peñoles and Cia. Metalurgica Peñoles, says, "When we undertook the project, we considered it a necessary step but a risky one. Now that the tunnel is well under way, we feel much more comfortable—especially since we found that additional ore."

Other officers at Monterrey include J.W.F. Dulles and H.A. Tanner, each assistant general manager of both Peñoles' companies; J.B. Malcolm, chief mining engineer in charge of mining operations; C.T. Williams, general superintendent of mines; E.J. Ettles, chief design engineer, and Rodolfo F. Barrera, director of industrial relations for Cia. Minera de Peñoles.

At Avalos, officials include J.A. Engstrom, manager, Avalos Unit; Paul Pyburn, assistant manager; D.C. Peck, mine superintendent; J.B. Cameron, Peñoles resident project engineer, and G. Baly, mill superintendent.

Photo #1

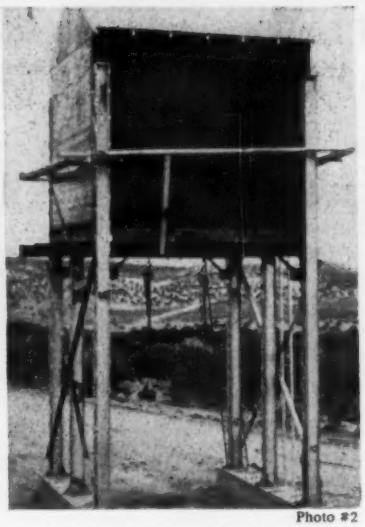


Photo #2

IN "BANDUT," nitrate is oil-sprayed as it falls through pipe from measuring hopper. Raised bin is used to fill tilting box.

Better AN Loading = Even Lower Costs

DONALD M. STROMQUIST

AFTER THE FIRST SAVINGS of ammonium nitrate blasting were realized, large and small operators alike have been searching to get "the last squeal out" and now have come up with procedures that do just that—cut handling through mechanization and boost efficiency through better mixing, as well as load bore holes quickly and safely.

Tilt-Box Feeds Bulk Nitrate

Utah Construction Co. recently became interested in more efficient handling and loading of the ammonium nitrate-fuel oil blasting agent into large down-holes for stripping waste and mining ore in open pit operations at Cedar City, Utah. The company's thinking resulted in the construction of a unit that was dubbed the "Bandut" (Bulk Ammonium Nitrate Dispenser by Utah). The loader consists of a measuring hopper-dispenser, nitrate storage-box, oil storage-tank, air-winch hoist and air compressor, all mounted on a flat-bed truck (photo 1).

Utah Construction currently fills the truck with bagged material but soon will take a further economic advantage by putting a bulk storage bin into service (photo 2). This bin is still under construction and was fabricated for the most part from on-hand material. The container itself will hold about 36 tons. The bin will receive bulk ammonium nitrate shipments and the nitrate will be transferred from the bulk truck to the inside of the bulk storage bin through a top opening. Two discharge spouts at the bottom of the bin, complete with butterfly valves, will be utilized for quick gravity loading of the "Bandut." The two chain-falls at the bottom of the bin are located so they can grasp and store the "Bandut" in a protected position and thus free the flatbed truck for other duties during non-loading periods.

The "Bandut" box holds about 2.8 tons of ammonium nitrate. An air-operated winch with air compressor, behind the truck-cab, is used for tilting the box. This allows the nitrate to gravity feed through a gate into the 300-lb capacity measuring hopper at the back end of the truck. From the hopper the nitrate is admitted to the bore hole by opening a butterfly valve in a 6-in. pipe on the bottom.

A cone was installed in this pipe in order to force the nitrate to fall through a 1¼-in. annular space at the periphery of the pipe. An oil nozzle was placed at the bottom of the cone to spray an atomized oil stream down on the falling ammonium nitrate. Actuation of the manually operated nitrate valve also operates an oil-line snap-valve through a mechanical linkage (photo 3). The oil valve admits a metered quantity of oil at 100 psi to the nozzle. An excellent 6% oil-94% ammonium nitrate mixture is obtained at all times.

By using such a bulk loader, a bore hole can be completely loaded with 200 to 300 lb of nitrate mixed with oil in 20 seconds—a real accomplishment.

Toe Hole Loader Uses Air

Another western mining concern had an ammonium nitrate handling problem and solved it in a different way. In this operation, 3-in. dia. toe holes are drilled at about a 45 deg angle to the horizontal and "sprung" or chambered with conventional explosives. It was difficult and time-con-

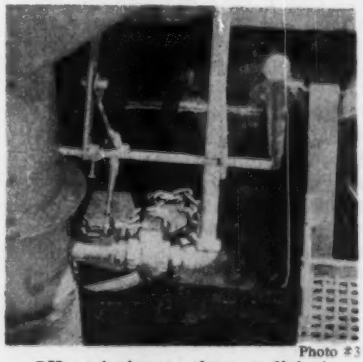


Photo #3

OIL and nitrate valves are linked.

Mr. Stromquist is technical representative with the Coal Chemical Sales Division of United States Steel Corp., Salt Lake City, Utah. His paper was originally presented at the Rocky Mountain Coal Mining Conference in July.

Photo #4

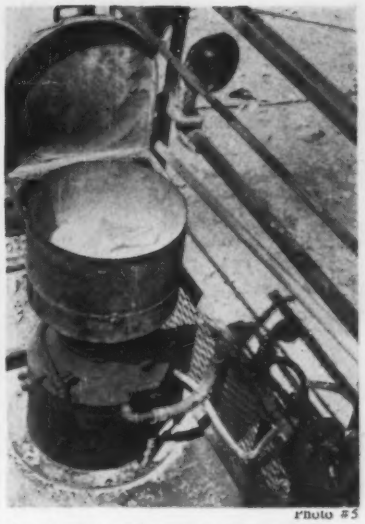


Photo #5

AIR-PLACER is used for loading flat holes. In blower, AN drops from hopper into air chamber and out venturi into hose.

suming to load any type of explosive into such a small hole in a satisfactory manner. As soon as the operators started using ammonium nitrate, they developed an air loading procedure that is excellent for their purposes and would be for any other operator interested in moving and loading ammonium nitrate pneumatically.

The rig consists of a blower, 125-cfm rotary air compressor, diesel fuel tank, hose reels, valves and other accessories mounted on a four-wheel drive truck (photo 4). The blower was designed and fabricated by the concern in its own shops. Dry ammonium nitrate is first poured from bags into a top storage hopper (photo 5) from which, by means of a bell-valve, it is let into a lower hopper tank. The hopper-tank is fed 35 psi air pressure which shuts the bell-valve tightly and aids gravity in moving the nitrate into an air venturi at the bottom. The venturi, also fed 35 psi air, moves the ammonium nitrate into a rubber hose.

As the nitrate starts to flow, a metered quantity of oil is forced, by air and a floating piston, through an adjacent smaller hose to a junction point (photo 6) near the bore hole where the dry prilled ammonium nitrate and atomized oil meet and mix. From this point the nitrate-oil mixture is forced through a pipe into the bore hole until the hole is loaded with the proper amount of material.

An excellent oil-ammonium nitrate mix is obtained, due in large part to excellent oil atomization, which is evidenced by blowing oil alone through the line.

The ingenious loader has enabled the western copper concern to move nitrate into its hole properly treated with oil at the rate of 100 lb in 100 seconds.

Gravity-Hopper Is Simple

After using ammonium nitrate for some time, the Michigan Limestone Div. of United States Steel Corp. at Rogers City, Mich., recognized the need for insuring a proper hydrocarbon-nitrate mixture as well as the cost advantage of developing a handling system that would reduce the manpower requirements of the loading crews. The rig (photo 7) that resulted is a three-ton truck equipped with fuel-oil tank and an air compressor. It is used for transporting the bagged nitrate and mixing it with oil as it moves by gravity through a pipe from a loading hopper into the hole (photo 8).

As the nitrate flows out of the hopper it strikes a gate flow-controller and electrically operated relays open a solenoid valve on the oil line that delivers the oil under pressure through six spray nozzles located

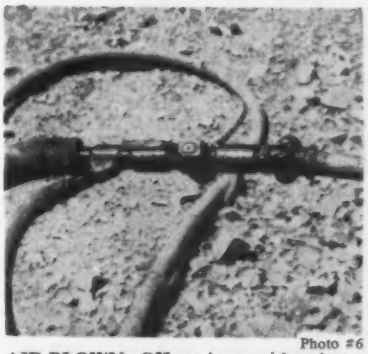


Photo #6

AIR-BLOWN OIL mixes with nitrate just before entering hole-charging pipe.

Photo #7

HOPPER receives needed amount of AN which is oiled in gravity-charging spout.

Photo #8

CHARGING SPOUT can be raised and lowered by cable from small jib crane.

around the nitrate discharge pipe (photo 9). The proper mixture of oil and nitrate is obtained by controlling the gravity flow of the nitrate out of the hopper and by metering the oil as it is sprayed into the falling nitrate stream. The oil meter is mounted on the left rear of the truck.

Use of this truck loader, for which Michigan Limestone is processing patent coverage, has enabled the firm to cut loading crew requirements from eleven to six men and obtain maximum use of manpower to load the holes more quickly, and to obtain a uniform oil-ammonium nitrate mixture that insures maximum utilization of its blasting properties.

Certainly these are not the only ways of handling ammonium nitrate efficiently, but they represent a step in the right direction. Other developments such as refinements in bulk handling, use of ammonium nitrate in wet holes and use in approved underground locations, to mention a few, will result in further cost reductions for the mining industry.

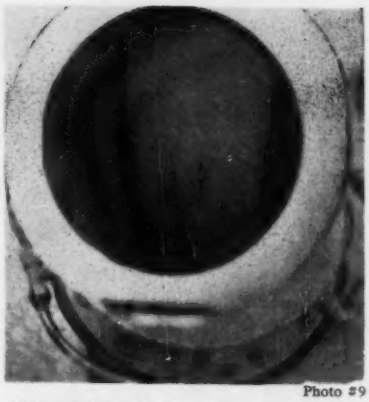


Photo #9

SIX-NOZZLE oil-spray is actuated by nitrate as it flows against gate in pipe.

What Is FGAN and How Is It Used?

THE REDUCED MINING COSTS resulting from using Fertilizer Grade Ammonium Nitrate to locally compound a blasting agent are being increasingly realized in all types of open pit mines, quarries, road building and other surface blasting applications.

Fertilizer grade ammonium nitrate is a compound of nitrogen, hydrogen and oxygen (NH_4NO_3) and, as such, is a powerful oxidizing agent. Most of the ammonium nitrate used today for compounding a blasting agent is made by combining nitric acid and anhydrous ammonia to form a solution of ammonium nitrate. This solution is concentrated by evaporation to the point where it will solidify immediately when cooled. To form near-round pellets or so-called "prills", the hot ammonium nitrate solution is sprayed from the top of a tall enclosed structure called a prilling tower. The prills thus formed are dried, cooled and coated, generally with diatomaceous earth, to aid in preventing the hygroscopic ammonium nitrate from caking due to adsorption of ambient moisture. This, briefly, is the story of how ammonium nitrate prills are made; let us now examine the methods by which the material is converted into a blasting agent.

Under the most ideal conditions, elevated temperature and pressure make the ammonium nitrate molecule decompose as follows:

$$2NH_4NO_3 \xrightarrow[\text{pressure}]{\text{heat and}} 4H_2O+2N_2+O_2,$$

with the end products, of course, being gases. The oxygen formed is readily available for a continuing reaction with combustible material, such as a hydrocarbon, which forms CO_2+H_2O (gases again) and greatly increases the explosive strength. The combustible also makes the mix more sensitive to detonation. This reaction is substantially a surface one, and it is advisable to obtain an intimate mixture of the ammonium nitrate and the hydrocarbon in order to effectively strike an oxygen balance and thus gain maximum power as cheaply as possible.

The knowledge of these fundamental facts, the great economy of using FGAN in compounding a blasting agent, and the safety of handling the material have all contributed to its rapid growth and present stature in the mining industry.

Field Practice Reviewed

Operations using ammonium nitrate vary a great deal from one location to another but some generalities encountered in use can be itemized. Most users begin by using the same powder factor (i.e., amount of nitrate-carbon mixture per ton of material to be broken) and identical drill pattern as previously established. Some operators report that they have been able to increase their hole spacing by using ammonium nitrate prills. Bore holes varying in diameter from 2 to 12 in. are now being shot successfully at numerous locations.

Hydrocarbons used as sensitizers vary greatly, but it is safe to say that diesel oil or fuel oil are predominately used because of their ease of handling, ready availability and excellent mixing characteristics. The weight ratio of 6% hydrocarbon to 94% ammonium nitrate (just under about 1 pint of oil per 10 lb of nitrate) is the oxygen balanced mixture.

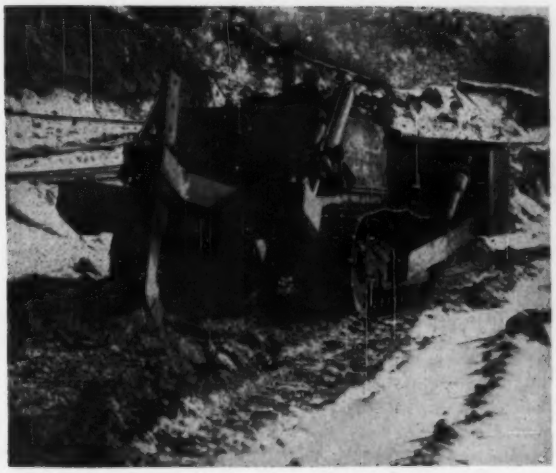
The hydrocarbon is often added directly to nitrate in the opened bag and allowed to percolate down through the bag of material. It has been reported by several operators that they received better performance if the ammonium nitrate is mixed with oil and allowed to stand for 24 to 72 hours or even longer. If better results are actually observed under these conditions, it must be due to superior oil or hydrocarbon penetration and mixing over such a protracted period.

Some operators pour the dry nitrate into the bore hole and then add the oil, but there is good likelihood that oil added by this method can be easily lost due to seepage into the area around the bore hole and may never contact portions of the ammonium nitrate at all. Other methods are discussed in more detail in the accompanying main text presented above.

Regardless of the sensitizing procedure used, the ammonium nitrate-hydrocarbon mixture must be treated, stored handled as an explosive. In addition, it is wise to dispose of the empty ammonium nitrate bags daily by burning.

A high explosive primer must be inserted into the bore hole to cause detonation of the oil-ammonium nitrate mixture. The majority of the operators bottom prime with dynamite or other selected high explosives, although other priming locations in the hole are frequently used. The amount of primer used varies considerably, with some operators successfully detonating a hole with one stick of 1½x8 in. gelatin, while others use 5 lb of a similar explosive per hole and yet others standardize on using conventional explosives weighing 5% of the ammonium nitrate weight. Primer type and amount seem to be a matter of personal preference at each location although experiments indicate there is some certain minimum for maximum utilization of AN. Electric blasting caps and Primacord are both widely used for primer detonation and, of course, it is advisable to use stemming. Delays can be incorporated as warranted.

Whichever of the above methods is used, it is certain that fertilizer grade ammonium nitrate is paying dividends to the mining industry today and has found its permanent niche in the industry.



AFTER RIPPING the first pass to about 6-in. to loosen surface for better traction, the tooth is gradually lowered.

WITH TWO TEETH at full depth, a Caterpillar D9 tractor-ripper shatters hard rock at much lower cost than by blasting.

Tractor-Ripper Slices Frozen Ground

FROZEN OVERBURDEN can now be broken for shovel loading in many instances at less than the cost of explosives alone. A new technique, announced by the Caterpillar Tractor Co., uses a crawler tractor-mounted ripper to break frozen material and has proved itself to be cost-saving (by more than one-third on typical jobs), fast and practical.

Many specialized rippers have been built. One, with a single tooth, can be pushed by a second tractor to obtain needed force and penetration. Pipeline and coal rippers have extra heavy frames and long teeth. Mountings, frame and body structures and controls made by various manufacturers are similar, but shanks, boots and points vary widely to meet field conditions.

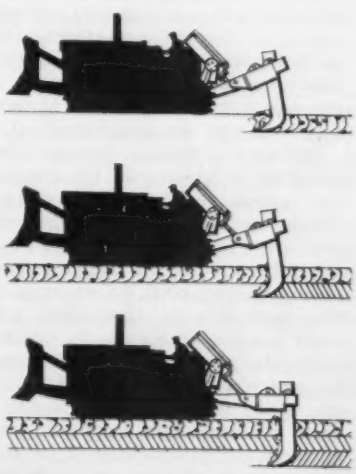
Constant power for raising and lowering the draft frame is provided by a power-take-off pump. A clevis, mounted on the draft beam, holds the ripper shanks. In some types the clevis has swivel action, easing tractor steering and permitting the shank to work around buried hard objects, reducing shock on the equipment.

The most important function of the clevis is to provide hole patterns for positioning the ripper shanks to meet the work at hand. Success or failure often depends upon depth and ripping angles.

Shanks fall into three categories—straight, curved and modified. A straight shank can successfully handle a wide variety of materials and penetration depths, due to its ripping angle and ability to stay down in blocky and slabby materials. Curved shanks work best in non-slabby materials, where the lift action gives good fracture for effective scraper loading. Some shanks have been modified to obtain a more favorable penetration angle. All shanks are designed to keep frontal area to a minimum while maintaining necessary strength.

Ripper points, regardless of size and shape, must provide good initial penetration, good fracture characteristics and good wearability.

No two ripping jobs are exactly alike, but there are some general conditions that may be considered. First, the material must be "rippable." Sedimentary rocks, such as limestone, offer the best opportunity, but disintegrated or weathered solid formations, such as granite, can also be ripped economically. Moisture can aid ripping by preventing bonding between hard rock laminations, but can be a hindrance in some clay, sandstone and limestone formations.



INITIAL PASS (top) provides traction for maximum penetration passes.

End use—graded, fill or waste—should also be considered. Graded material will be crushed or sized, so ripping patterns must be varied accordingly. Fill materials must be broken sufficiently to meet maximum sizes of specifications and handling. Waste material need be loosened only enough to permit economical handling.

Ripping procedures also vary for transportation methods. For dozing, a minimum of passes is made to give lowest costs. More passes must be made for smaller pieces for scraper loading. For loading by shovels, the material need be only small enough for the bucket to handle. Ripped material for stationary conveyors should be sized to prolong belt life and for moving along inclined sections. For mobile conveyors, the material must be of a consistency that the loader can be pulled through it.

During ripping, the tractor usually works in first gear to keep from stalling on hard spots. Normally it is advantageous to start ripping with one tooth, adding more if the material is penetrated easily and breaks into satisfactory sizes. In slabby material, two or more teeth may act as a rake, reducing production.

By mounting the ripper on the rear,

Typical Ripper-Blasting Cost Comparison

(Assuming 100 cubic yd per hr production)

	Ripper	Blasting	
Equipment			
320-hp diesel tractor equipped with ripper and dozer		1—600 cfm compressor 2—3-in. wagon drills 1—125 cfm compressor 1—Jack hammer	
List Price			
$53,000		$28,000	
Hourly Cost			
Owning			
Depreciation	$6.62	$2.80	
Int., ins. & taxes	$1.59	.84	
	$8.21	$3.64	
Operating			
Fuel	$1.68	$ 1.25	
Gas	$ .03	$ .03	
Oil & filters	$ .32	$ .35	
Repairs, inc. labor	$6.62	$ 3.00	
	$8.65	$ 4.63	
Labor			
1 Operator	$2.50	$ 7.50	3 Drillers
		$ 3.00	1 Powder man
		$ 2.00	1 Helper
	$2.50	$12.50	
		*$10.00	Explosive
		$22.50	
Total Hourly Cost	$19.36	$30.77	
Cost Per Cubic Yard	$\frac{\$19.36}{100}$ = $0.19.4	$\frac{\$30.77}{100}$ = $0.30.8	

Savings

Ripping costs about one-third that of blasting and the tractor can handle the loosened material.

*½ lb of powder @ $18.70 per 100 lb blasts 1 yd of rock.

Case History in Frost

Data supplied by: A Mesabi range iron ore company

Material: Clayey, sandy, boulder-strewn frost—imbedded boulders up to 1 yd in diameter

Area: Level surface, 8,100 sq ft

Method: Small diameter, self-propelled, crawler-mounted, air-powered drill

Holes: 270 (5-ft depth)

Shift: 8 hr—gross

Production: 50 holes per shift—5.4 shifts required

Labor:	5.4 Shifts driller 2nd	@	$19.20 =	$103.68
	5.4 Shifts driller helper	@	18.16 =	98.06
	1 Shift blaster	@	20.24 =	20.24
	1 Shift blaster helper	@	17.12 =	17.12
				$239.10
Explosives required:				$345.00
Machine expense:	43 hr of Air-Trac Drill	@	$3.35 =	$144.05
Estimated Cost of Drilling and Blasting "Hard Frost" Area				$728.15

Estimated Cost of Ripping—Same area and material

Method: D9 Tractor and Ripper
4 initial passes and one cross-ripping pass
Doze off first layer and repeat process once

Production: 14 hr to rip 8,100 sq ft area

Labor:	14 hr—tractor operator	@	$2.45 =	$34.23
Machine expense:	Rate for D9 & ripper—repair & maintenance, depreciation, supplies, etc—$21.00/hr—14 hr	@	$21.00 =	$294.00
Estimated Cost of Ripping "Hard Frost" Area:			=	$328.23
Savings:			=	$397.92

the traction and weight of the tractor can be used to the best advantage. Unlike towed rippers, which simply trail the prime mover applying no external down pressure, the mounted ripper concentrates most of the weight of the tractor-ripper on one point—the tooth tip. Greater improved penetration is reached faster. Only the crawler's traction and the tooth length limit the unit's ability to break ground. In general, it is best to rip as deeply as possible. However, this may raise the rear of the machine off the ground or take too much weight off the front idler, reducing traction and production and increasing maintenance.

Success of the ripping technique depends on the establishment of an effective ripping pattern. In all materials encountered, Caterpillar found that using furrow centers of 4 ft, equal to about half the width of the tractor, produced the easiest handling material. Ripping begins by covering the entire area with furrows on 4-ft centers at a depth of 6-in. The primary purpose here is to provide additional traction for further passes. As many additional passes are made as are necessary to thoroughly break up the area. According to the situation encountered, this may be as few as one or as many as three passes in each furrow. The 8-ft ripper tooth produces a heaving action, chipping and cracking frozen overburden. Following the cracking, the frost breaks into pieces as the tooth passes through. Results show that cross-ripping at right angles to the initial passes is the most effective method to complete a ripping sequence. During cross-ripping, the tooth pushes on the material from a new direction, taking advantage of different points of weakness to thoroughly shatter the frozen material.

Although production ripping offers the greatest opportunity for continuous savings, "utility" ripping can result in spectacular savings when the need arises on "odd jobs" where moving and setup time are a large portion of the blasting cost. An example of this, according to Caterpillar, was when a mine-railroad grade crossing had to be constructed. The D9 tractor and Kelley ripper moved to the job, ripped out the frozen surface to a depth of several feet, leveled the area to grade and moved back to its production ripping assignment—all in just two hours. The principal advantages of the tractor-ripper on this job were its speed and ability to complete the job alone with a minimum interruption of traffic; without the danger and expense of shooting.

At another mine on the Minnesota iron range, the unit built a road through a frozen ore pile to a wrecker shed. A few hours before, a tractor without a ripper had tried the same job and couldn't dent the material with its bulldozer. The road assignment was finished by the tractor-ripper between production jobs.

Applying the ripper technique, Caterpillar reports, a Mesabi range iron company was able to cut costs by a sizable margin. The material was clayey, sandy, boulder-strewn frost, and considered "very tough going." A four-man crew of drillers and blasters required 5.4 shifts to adequately loosen 8,100 sq ft, 5 ft deep in frost. A Caterpillar D9 tractor, working an identical area, made four initial passes and one cross-ripping pass. The first layer was dozed off, and the process was repeated to reach the 5-ft depth. The D9 completed the 8,400 sq ft in 14 hours, cutting operating costs by more than 50% (drilling and blasting, $728.15; ripping, $328.00).

How To Measure Rock Pressures

K. P. GUPTA

HITHERTO, INTELLIGENT GUESS WORK has been our main tool of investigation into rock pressure problems, but now we are able to base our conclusions upon the results of instrumental observations and we are thus in a position to approach rather more closely to a truer understanding of the various effects than was the case before. Many of the various conditions under which rock fails are known, but to determine the particular cause responsible in any given case of failure may necessitate difficult and lengthy investigations. It should be our aim, therefore, to learn as much as possible concerning this complex question.

At first the study of rock pressures underground was based upon the examination of visible features such as shear or tension cracks, observed before and after rock failures. These studies were reinforced by statistical methods of investigation which resulted in many satisfactory and conclusive results. But observations under different sets of conditions and in different types of rock were bound to be conflicting and thus largely divergent theories and views were put forward from time to time. Nevertheless, each of these theories had a core of truth as applied to the local conditions which appertained when the various theories were framed.

The next period consisted of a research into basic principles which could be used for assessing varying rock pressures scientifically. A number of various physical effects which varied with pressure were observed and an attempt was made to utilize them for underground stress-measurement. Considerable success was attained in proving the validity of the principles but the design and accuracy of instruments placed a limit upon the achievements attained.

Today, however, as a result of greater improvements in all branches of science and engineering, improved instruments have opened a new chapter and a closer approach to the solution of the various problems has at last become possible.

Mr. Gupta is assistant research officer at Champion Reefs Gold Mines, Oorgaum Post, Kolar Gold Fields, Mysore State, South India. His original paper was presented at a meeting of the Kolar Gold Fields Mining and Metallurgical Society.

Data Wanted

The principal difficulties involved in a complete solution to pressure problems have resulted from a lack of information concerning:

One, the magnitude and direction of inherent pressures in the rocks of any specified region. For example, the Kolar Gold Fields Rockburst Sub-Committee Report of November 1926 states: "It has been suggested that there are zones of high stress in local schists and that rockbursts mostly occur in these zones on account of extra stresses there. The fact that released energy in bursts is much more than the potential energy of the walls favors the assumption."

Two, the type and magnitude of induced stresses due to mining operations. This is particularly important in connection with "crush bursts." In this connection it is commonly believed: that extraction of rock during mining operations (stoping) throws its share of load both ahead and behind the face (these regions being called front and back abutments respectively) and an investigation into the resultant stresses would give some idea of the zones liable to bursting; and that the stress distribution around and ahead of a development excavation is intimately concerned with the occurrence of development bursts—particularly while holing to already existing excavations.

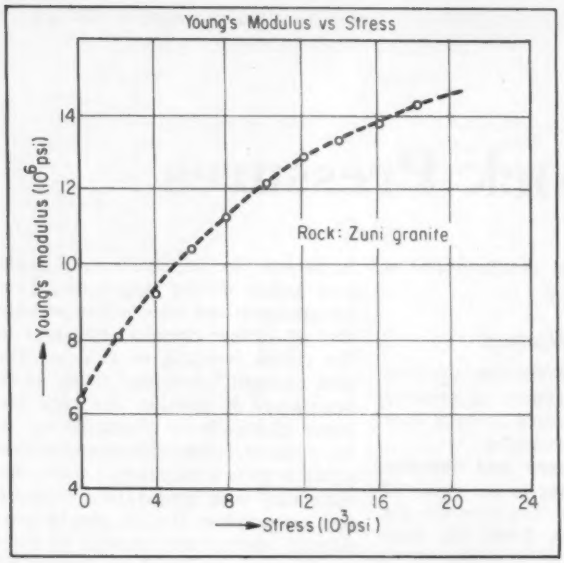
And, three, the behavior of rocks under increasing forces and particularly their behavior prior to failure. The varying composition of rock is one factor to be taken into account when assessing rock behavior. It is also of advantage to know important representative physical constants for the rocks in different sections of the mine, particularly as changing values of physical constants may effect the readiness with which bursts occur. Thus, T. Pryor suggested in the above-mentioned report that, "schists of lower density appear to be more liable to burst than the denser variety; that determination of free CaO or MgO, etc. might help in deciding liability of arching or spitting, and that knowledge of accessory minerals in or near the contact surface might give a clue to the magnitude of inherent stress and also to the possibilities of further chemical reactions in the future resulting in reducing the rock strength." A further factor to be determined is whether the rock behaves elastically or plastically up to the point of failure. The question also arises as to how its physical characteristics vary with temperature, pressure and composition. It must also be considered whether the behavior of fractured rock can perhaps better be studied by means of the laws of soil mechanics, since where different laws of behavior apply over different stress ranges, it will be necessary to determine the limits of the relevant stress range over which each individual mode of behavior applies.

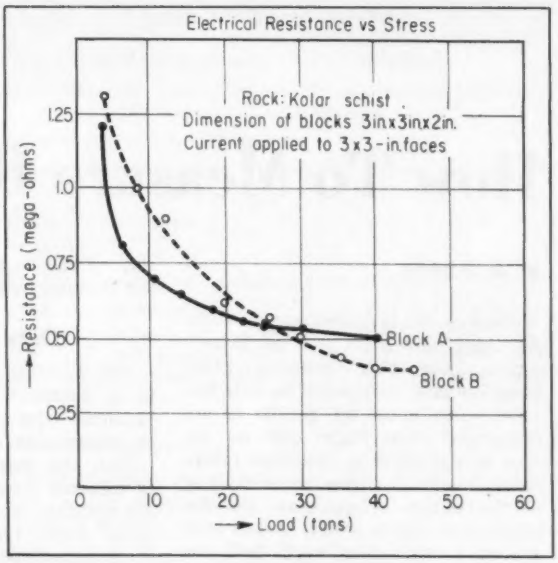
General Plan of Attack

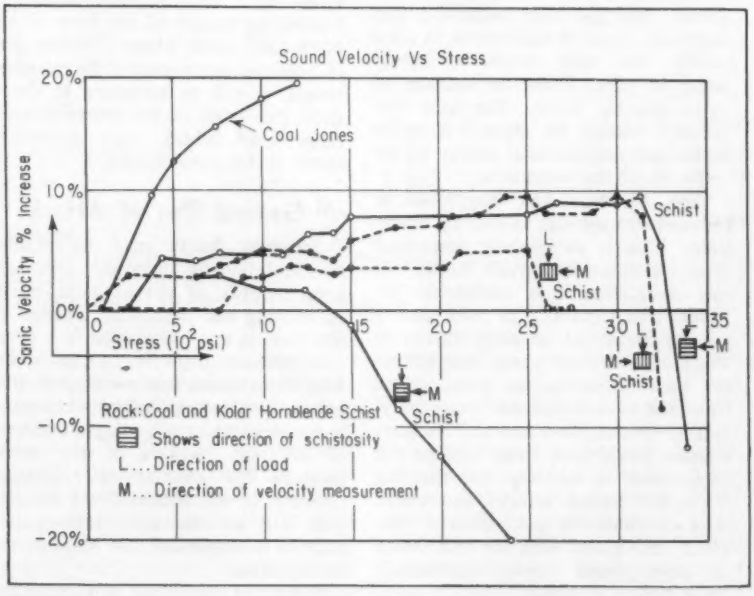
Inherent forces may be studied by the following suggested approach: keep records of development bursts or arching and determine whether or not there is any association in a given zone between high frequencies of development bursts and subsequent difficulties in pressure control when stoping; investigate the geological history of different sections of the mine; measure the amount of relaxation (closure) of the footwall and hanging wall into an excavation immediately after its development; and measure the actual stress.

It may be noted that an attempt has been made by Tincelin[1] in the French iron ore mines to estimate inherent stresses by attaching an acoustic strain gage (described later) in the center of a face, after which the rock to which the gage is attached is allowed to relax on isolation from the surrounding stress field by cutting a groove all around the assembly. It is assumed that rock behaves elastically and that the amount of relaxation on isolation is proportional to the previous pressure. It should be further noted that encouraging results have been obtained with this method in the Kolar Gold Fields.

Induced stresses can be studied by fixing stressmeters and load cells (described later) in the solid ground with their blades—carrying normal loads —set at different angles. Such installa-







tions can be made in boreholes at any required depth or site. Load cells can also be installed in the packwall or fillings to determine support loads in the stoped areas.

Variables to Measure

Important principles which may be used in the assessment of rock pressures are given as follows:

Strain or closure may be measured and translated into stress on multiplying by the elastic modulus "E." The "stressmeter" directly measures compressive stresses acting on its blades, while equipment for measuring closure includes the micrometer turnbuckle, strain bar, sagmeters, etc. (all described later). The stressmeter, load cells and acoustic gages can be calibrated directly for load by using loading machines in the laboratory.

It should be noted that the elastic modulus of rock, defined as stress/strain, is not a constant but increases with high pressures. (See graph). Equipment suitable for investigation is the Modulusmeter.

Regarding closure, it has been noticed that the rate of closure with time follows a logarithmic curve as conditions tend continually to a state of equilibrium. Logically, it might be said that any clear diversion from this law with the progress of time indicates a departure from the normal tendency to equilibrium. To interpret this, we may say that an abrupt increase in the rate of convergence during a period of observations may be regarded as resulting from an active build-up of forces in the walls.

Electrical resistance of strata, decreasing with increase in stress, may be measured.[2] (See graph). A change in resistance will also occur when the rock mass develops minute cracks as a result of formation of a fracture zone in rock or just prior to actual failure of rock. The assumption is that an internally fractured rock will have a greater resistance than rock in the normal unstrained state.

Natural emf has also been suggested[3] as indicative of stress. It is said that frictional movement along the fracture or shear planes of a rock causes a sudden impulse of emf, the emf so generated being largest just before the actual failure of the rock. This seems to be a very interesting property particularly where quartz reefs are concerned because of their piezoelectric character and needs further laboratory investigation.

Velocity of sound through a rock mass increases with stress up to the point of fracture. The value of velocity then falls sharply after the development of minute internal fractures in rock prior to the actual failure. (See graph). It has been concluded that sound energy transmits itself through solid media both in the form of longitudinal or pressure waves and transverse or shear waves. The longitudinal waves travel with a greater velocity and are easier to pick up with transducers. (A transducer is a device which converts mechanical vibrations into electrical signals or vice versa.) These waves are the subject of experiments in our research.

It has been confirmed experimentally that the pressure wave velocity in-

creases with increase of stresses in the material, this being attributed to the change of modulus with increase of pressure but when internal fractures are developed within the rock, the velocity falls abruptly. Experiments have been conducted in detail by L. Obert[4] in the U.S. with the idea that representative samples should be taken from each mine pillar and their pressure velocity characteristics should be determined in the laboratory. Subsequent to this, periodic observations of velocity should be made in individual pillars underground and any variation in velocities may readily be translated into stress changes.

Minor sub-audible vibrations within a rock mass are believed to diverge considerably from normal in frequency and amplitude before the occurrence of a serious burst. The practical miners' use of sub-audible noises as a warning of impending failure utilizes roughly the same principal.[5,6]

Evolution of heat is thought to accompany an increase in strain energy or readjustment of forces under adiabatic conditions such as would probably exist in a block of ore, and thus possibly results in a rise of temperature of the rock within the block. Qualitative results may be obtained by placing sensitive thermostats in long boreholes and observing the temperature variations within a block of ore under extraction.[7] Satisfactory results will probably only be obtained when the block of ore is being subjected to large and rapidly changing forces.

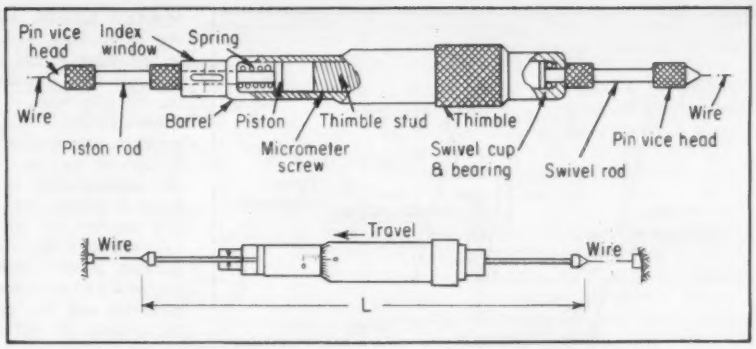
Size of blasted rock, visually observed, is a further method of minor importance. There is a general tendency for the mean size of these to be smaller in regions of high stress, when other things, such as explosive consumption and rock composition, are equal.

Measuring Strain & Closure

Strain and closure measurements can be taken using various methods.

Micrometer and vernier scales are used respectively in the micrometer turnbuckle and the vernier strain bar (see drawings). The first of these is more accurate (least count 0.001 in.) and is suitable for measuring wall closure or movements of very small magnitude in crosscuts. The second possesses the advantage of simple construction and operation and is very convenient for measuring large scale (least count 0.001 ft) closure of walls such as is common in stopes.

Sagmeters also are used for measuring wall convergence. These incorporate a wide range of construction. The simplest type is similar to the micrometer turnbuckle, having a telescopic



MICROMETER TURNBUCKLE has the following essential parts*:

a. Swivel rod with cup and bearings and pin-vice head having a blind hole. For clamping the wire in the correct position, the end of the wire must be in contact with the end of the blind hole. Rod connects pin-vice and thimble and frees the wire from tension kinks when connected to the pin-vice head.

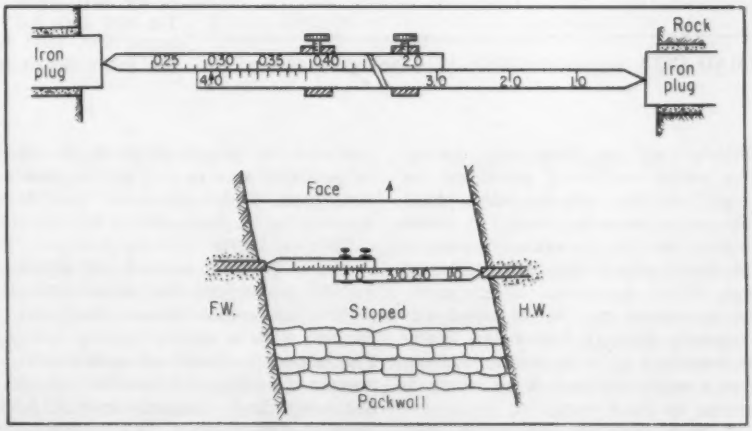
b. Thimble with micrometer screw. The outside of the thimble shell is graduated circumferentially in 50 parts. The screw (20 turns per in.) stud inside advances 0.05 in. in one complete revolution, giving a least count of $0.05 \div 50 = 0.001$ in.

c. Barrel. This is a tube internally threaded (20 turns per in.) from one end to accommodate the advance of the micrometer screw stud and smooth at the other end to accommodate a piston. The outer surface of the barrel, over which the thimble advances, is marked with 0.05-in. divisions. Towards the piston end a view slot is cut in the barrel wall and a reference line is marked on it.

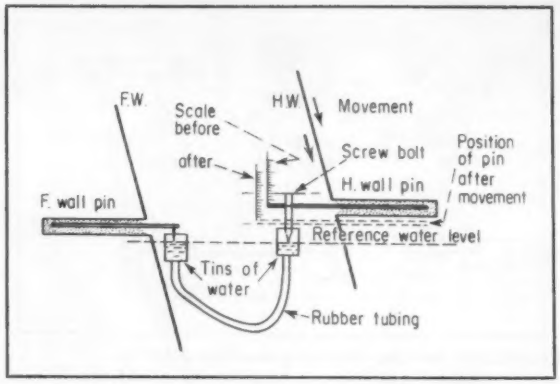
d. Piston rod with piston, spring and pin-vice head. The piston fits into the barrel and the spring is fitted over the piston rod between the barrel end and the piston. The piston moves along the axis of the barrel depending on the tension in the wire. There is a reference line on the piston rod to coincide with the reference line on the slot in the barrel, thus indicating a standard tension in the wire. In achieving this tension the spring roughly shortens from ⅞ to 1½ in.

The free ends of two wires, the other ends of which are rigidly fixed to plugs in the rock, are attached to the pin-vice ends of the micrometer turnbuckle. When the thimble is advanced, length "L" shortens and the tension in the wire increases. The increase in tension causes piston rod to move and at one particular tension the mark on piston rod will be in line with the reference mark on barrel. The reading at this position is then recorded. Should the anchor plugs subsequently move nearer or farther from one another, the same movement will have to be met by advancing or retarding the thimble to obtain the required coincidence of marks. The difference of two micrometer readings will then give the extent of the movement.

*Potts, E. L. J.: "A report on the organization of research investigations into the problems of rockbursts in the mines of Kolar Gold Fields."

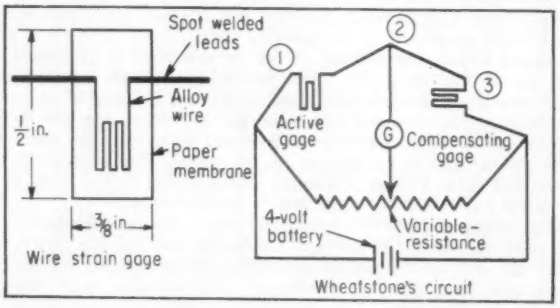


VERNIER STRAIN BAR, as the name indicates, utilizes the principle of the verniergage. It consists of two steel bars sliding over one another within sleeves. One bar (upper in drawing) is graduated in 0.01-ft divisions up to the 2-ft mark from the taper end. The other bar is graduated only in 1-ft marks from the taper end. The last 0.09 ft from the 4-ft mark is divided in 10 equal parts and then gives a least count of 0.001 ft. While in use the bar ends (tapered) are pulled out so as to come into contact with the reference plugs as shown in the drawing. The distance between the two plugs is then equal to 4 ft plus the main scale reading on the vernier. This particular bar has a range of 4 to 6 ft.



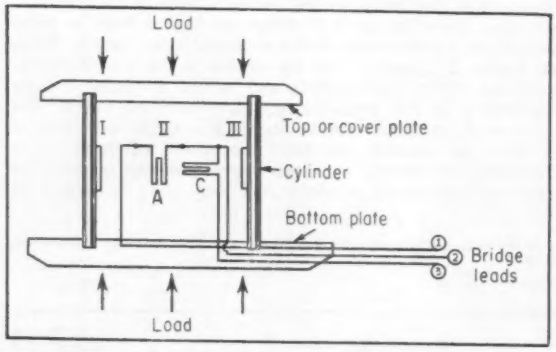
WATER LEVEL METHOD has been described* as follows: An 18-in. long, ⅞-in. diameter pin with an attached pointer is cemented in the foot-wall hole. A second pin, fitted with a screw bolt, capable of vertical movement, is cemented in the hanging wall. A water level is established using two tins connected by a rubber tube in such a manner that the two pointers are just touching the water surface in the two tins. In use, the tins are filled with water—care being taken against air locking—and held below the plugs. If necessary, more water is added drop by drop to the footwall tin until the level just touches the tip of the pointer. The screw bolt is then adjusted such that its tip touches the water level, and the bolt position is then read on a scale. The relative movement of footwall and hanging wall results in changed readings for bolt positions and the difference of successive readings will give the amount of vertical movement.

*Report No. 1, Rockburst Research Unit, Kolar Gold Mining Undertakings, Government of Mysore.



ELECTRICAL RESISTANCE STRAIN GAGE consists of a grid of fine alloy wire cemented to a paper membrane, (see far left). The gage is normally covered with a layer of felt both to protect the wire and to reduce the effect of draft. The whole may be cemented to the surface of the instrument designed to take the pressure under investigation and any pressure acting parallel to the length of wire will then strain it causing a resultant proportional change in resistance. This latter can be measured accurately using the principle of Wheatstone's Bridge (see left) and using a mirror galvanometer to indicate the null-point in the bridge circuit.

Humidity causes breakdown of the insulation and corrosion of gage wire resulting in considerable rise in its resistance. Every precaution should be used to keep the gages dry.



LOAD CELL consists essentially of a hollow cylinder which is machined from solid drawn carbon-chromo-molybdenum steel, a high tension steel of 50 to 60 tons per square in. strength. The top and base are covered by plates of suitable size and the contact surface between cylinder and plates is machined to within 0.001 in. tolerance. In order to insure a perfect contact, and to avoid concentrated or point loadings on the cylinder, the respective surfaces are rubbed together after a thin layer of liquid carborundum suspension has been placed in between. Three pairs of resistance strain gages, spaced at 120 deg intervals are attached to the inner surface of the cylinder. Each pair is comprised of an active and a compensating gage, the former having its wire elements parallel to and the latter normal to the direction of the load.

The top cover has provision for countersunk bolts anchoring in the base plate, in order to keep the assembly together. The base plate has provision made for the necessary electrical connections. Mild steel cable glands are provided at the base and the whole is waterproofed with suitable compounds.

cylinder with a piston and spring. The piston rod being graduated for length. As wall closure takes place, the piston is moved from its initial position and the amount of movement can be obtained from the graduated scale. When the closure is very small, the movement may be magnified mechanically through levers and finally be imparted to a style arm moving over a paper-wrapped drum which is rotated by clock work.

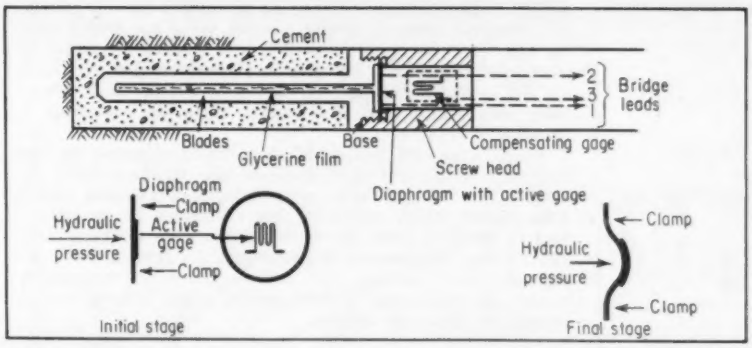
A fluid pressure principle is used in the hydraulic "flat jack." This consists of two steel sheets, size 18x12x⅛ in. thick, welded together around the edges to enclose a thin gap between them. Liquid in this gap is led direct to a pressure gage through leak-proof couplings. Any load on the sheets will thus compress the liquid within the gap and the degree of pressure will be exhibited on the dial of the pressure gage. These jacks are suitable for burying in packwalls or fills after calibration in the laboratory.

The water level method (see drawing) is convenient for investigating relative movement between foot and hanging walls in steeply dipping reefs. Preliminary evidence of such movement may sometimes be obtained by observing finely divided detritus in hanging wall cracks.

Electric resistance strain gage instruments are very valuable in present-day research. They may be cemented in rock in situ or in fillings or support of stoped out areas. The two important instruments are stressmeters and load cells, also called prop dynamometers.

Stressmeters (see drawing) are used for the measurement of rock in situ, for measuring variations in induced stresses caused by mining activities (i.e., stoping) and for locating the front abutment zone ahead of the face. The material for cementing the instrument into a drill hole must be non-shrinking (see box). When measuring induced stresses, holes are drilled a day or two earlier than is required for the installation of the stressmeter so that the bulk of any rock relaxation related to the drillhole itself will have taken place prior to the insertion of the instrument.

Load cells (see drawing) are being used to determine the load transmitted to props or other temporary supports. They can successfully be buried to determine the load on a granite pack-



STRESSMETER consists of two welded blades about 8x1x¾ in. thick with 0.01-in. thick glycerine film in between. A thin film is used with a view to reducing the temperature effect. Glycerine is used because of its being non-corrosive with steel and of low compressibility. The blades are provided with rims to increase the accuracy and response to the applied load.* The closure of the plates is of the order of 0.001 in. per 1,000 psi for a particular design.† The glycerine film impinges against a circular metallic diaphragm, the periphery of which is clamped in place by the screw head. An active electric resistance wire strain gage is cemented onto the diaphragm while the compensating gage with identical characteristics is fixed on a separate piece and is held in position by screw from the extension of the screw head. The compensating gage is provided to counteract the effect of temperature, etc. on the active strain gage, thus insuring that the measured resistance change in the active gage is due to pressure only. The gage leads are taken through stressmeter head to a three core cable. The leads from the stressmeter are taken to a junction box of multimeter capacity and finally to a Wheatstone Bridge. The operation of a selector switch incorporated in the bridge enables connection to be made with any desired stressmeter for observation. This technique assists in taking observations from a remote position.

The working principle is as follows: The instrument is inserted at the bottom of a long hole in solid ground ahead of the working face. As the rock surrounding the stressmeter deforms, it exerts pressure onto the blades via a filling medium such as concrete made with expanding cement to counteract shrinkage. The blades of the stressmeter then tend to close in and the occluded glycerine film, being practically incompressible, transmits the resultant pressure to the diaphragm which, together with wire gage, then deforms. This amount is measurable by the amount of change in the resistance of the gage as determined by Wheatstone's Bridge method.

Calibration curves of known load against resistance change for each stressmeter are obtained in the laboratory before installing underground. Later these curves may be used to translate observed resistance into the equivalent stresses existing in the underground rock. The changes in stress value, with respect to face advance, gives an idea of the location of front abutment zone.

*Carlson and Pintz: "Design of a Stressmeter," *Journal*, American Concrete Institute, Nov. 1952.
†Potts, E. L. J.: "Stress distribution, rock pressures and support loads" *Colliery Engineering*, August 1954.

Hole Cement Is Important

MATERIAL FOR CEMENTING a stressmeter in a hole must be non-shrinking. As observed, concrete normally shrinks on drying and, if it be used to seal the instrument in a borehole, there will be danger of losing contact. The transmission of load from the rock via the sealing material should then not only be imperfect but also uncertain. To avoid this possibility, the following expanding materials have been tried* with partial success: rough plaster; pottery plaster; industrial fine plaster; and rapid hardening cement. Dental plaster of proper consistency has also been used with partial success in Canadian mines.

The most suitable material, however, consists of:
112 lb of Portland cement.
112 lb of sharp (dry) sand to 3/16 in. size.
¾ pint of Conplast. (A liquid used to increase fluidity and to ensure homogeneity and thereby strengthen the mixture.)
3 lb (1 bag) Cebex 113 (inclusive of $CaCl_2$). (A powdered expanding material used in conjunction with $CaCl_2$, the latter being to retard the chemical action.) The quantity may be doubled if extra expansion is required.
4½ gallons of water.

When mixing, the following procedure is adopted:
1. Add Cebex 113 to cement and sand and mix well in dry state.
2. Add Conplast to water in a container large enough to hold the complete charge.
3. Add the dry mixture gradually to the liquid portion, stirring continuously until all the lumps are disposed and the grout is in complete suspension.

*Cumpsy, J. S.: "Thesis work." King's College, University of Durham, 1956.

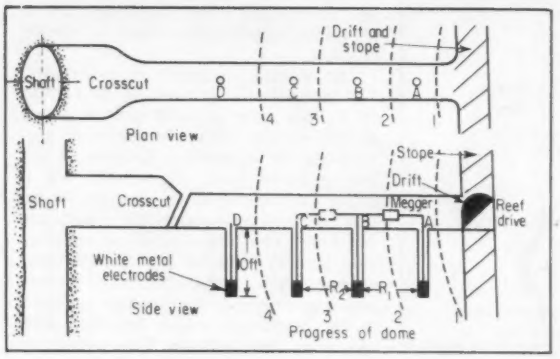
wall, concrete blocks or cyanide fills, and they may play an important part in proving the existence and position of the back abutment zone behind the working face.

Acoustic strain gage instruments utilize a taut-stretched thin steel piano wire. This measuring wire is attached directly or indirectly to the rock under test; for example, the ends may be fixed to bolts set in the rock. Any subsequent strain in the rock will then affect the tension in the steel wire and the magnitude of strain may be measured by the change in frequency of vibration of the steel wire. Frequency measurements are made by using a standard wire and manipulating it until the frequency of its vibrations coincide with that of the measuring wire. The extent of the manipulation necessary is recorded by a suitably calibrated dial. The coincidence of frequency is judged by displaying both standard and measuring oscillations on a double-beam oscillograph. The measuring oscillations are generally damped to obtain better facilities for the judgment of coincidence in frequency.

The above-mentioned principle is commercially utilized[8] in the manufacture of a variety of instruments for the measurements of such quantities as: strain; deflection or convergence; compressive and tensile forces; load; temperature; earth pressures; or seepage and pore water pressures. All the above equipment possesses the advantage of being remote controlled and enabling measurements to be made from a central point.

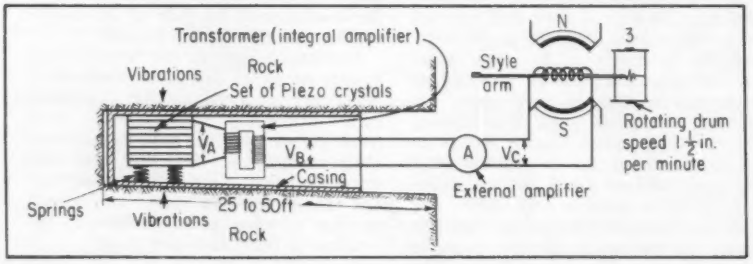
Measuring Resistivity

Electrical resistivity methods can possibly be used to determine the extent of the fractured zone behind a stoped area, especially where footwall and hanging wall crosscuts give access to country rock. Such information may be invaluable in deciding upon the most suitable site for a shaft. If periodic examinations are made, the development of the fractured zone may be noted progressively with time. (The accompanying drawing shows the diagrammatic layout in a particular case). This may be adopted to many underground situations and any sudden increase in resistance between two points indicates the depth to which the fractured zone has currently penetrated. The results can be checked



RESISTIVITY SCHEME proposed for measuring the growth of a fracture dome is simple. Several holes are drilled into the block and an electrode with a wire lead to the collar is placed in each. The electrodes and leads are left in place for the periodic readings. In the case shown, 10-ft downholes were drilled at equal distances along the bottom of a crosscut.

In use, some emf source and some means of measuring the resistance to current flow between any two electrodes is needed. The "Megger" is a very suitable high-resistance measuring device which combines these functions. It is widely used in electrical work for detecting insulation weakness and for checking effectiveness of grounding. An integral hand ac generator is a common emf source. Design of instrument insures that calibration is unaffected by speed of cranking or strength of permanent magnets.



GEOPHONE for receiving sub-audible vibrations consists of a two-layered Rochell Salt crystal (2½ x ¾ x ½-in. thick) housed in spring board fashion in 1¼-in. dia. by 8 in. long steel tube. The crystal is wrapped in silver foil. The vibrations received by the crystal compress it and generate a proportionate emf by piezoelectric effect. This is conducted through the silver foil to a lead for amplification. The electrical impulses on being amplified (about ½ million times) pass through a coil within the influence of a magnet which results in the production of a proportionate break in the linear trace of the style used for recording.

To make the unit proof against very high intensity shocks, a device is incorporated in the circuit which causes the record to vary logarithmically for abnormally strong input signals.

by measuring sonic velocity between the same set of boreholes.

Measuring Sound

Sonic velocity, in one of the more popular underground methods, is measured by means of a set of transducers used in conjunction with a cathode ray oscillograph. Two long boreholes are drilled in a solid rock mass and transducers are sited at the bottom. Mechanical vibrations are initiated from one end of the holes and received successively by the transducers in the holes. The amount of time which elapses for the waves to pass from one hole to the other is measured by means of the oscillograph and thus provides the necessary information for calculating the required velocity. In practice the terminals from the transducer in one hole are connected in such a fashion that they will trigger the horizontal beam of cathode electrons to sweep linearly and at a set speed. The terminals from the transducer in the second hole are connected to the vertical plates of the oscillograph. It follows that, when the vibration arrives at the second hole, a signal is transmitted to the vertical plates which become charged with a resultant disturbance in the linearity of the beam previously triggered by the signal from the transducer in the first hole. The amount of distance traveled linearly by the sweeping beam without vertical displacements is then divided by the speed of the sweep and this gives a measure of the time.

Sub-audible vibrations or snappings were used as a basis for a research project carried out at Lake Shore Mine in Canada.[6] The underlying idea behind this approach was that both amplitude and frequency increase prior to a major burst.

The observations were made in a block under extraction. A geophone (see drawing) was installed at the bottom of a hole drilled in the center of the block. This geophone picks up minor mechanical vibrations and converts them to electrical impulses in proportion to its original frequency and amplitude of vibrations.

Important conclusions drawn from this research are:

(a) That the geophones are sensitive only to sub-audible snaps occurring within a distance of 50 to 75 ft.

(b) There should be the best possible contact between the geophone and the rock, so that even small snaps may give a fair throw on the styles.

(c) Light disturbances fail to carry well across discontinuities in the rock mass such as faults or planes of layer separation.

(d) With experience, a critical frequency may be ascertained, above which value the location could be regarded as being in a state of unstable equilibrium and thus unsafe. If the frequency count falls later—working may of course be resumed.

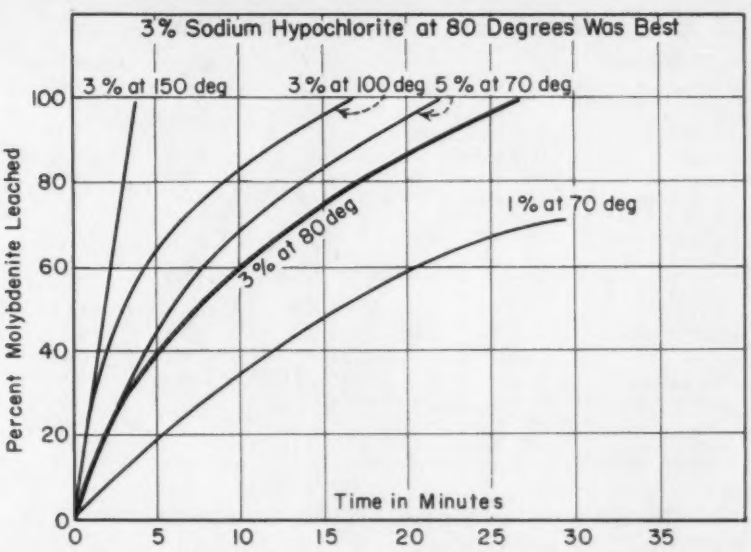
Similar results were obtained on simple rock falls in various workings in the U. S. A.[5]

Acknowledgment

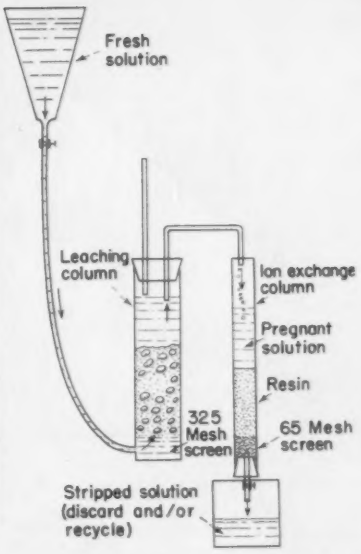
I wish to thank the Superintendent, Champion Reef Mines, for permission to publish this paper. I must also express my indebtedness to Prof. E. L. J. Potts, under whose guidance I learned the subject and to Mr. E. Isaacson for his valuable guidance and suggestion in this paper.

References

1. Tincelin, E.: "Research on rock pressures in the iron mines of Lorraine." International conference on rock pressure and support, Liege (France), April 1951.
2. "Report No. 3," Rockburst Research Unit, Kolar Gold Fields Undertakings, Government of Mysore (India), March 1957.
3. Weiss, Oscar: "Preliminary observations on apparent electrical resistivity changes in rocks under stress and emf caused by internal friction in rock fracturing." *Transactions*, Institution of Mining and Metallurgy (London), 1942-43, Vol. LII p. 365.
4. Obert, L.: "Measurement of pressures on rock pillars in underground mines," *R.I. 3444* and *R.I. 3522*, U.S. Bureau of Mines, 1939 & 1940.
5. Antonides, L. E.: "How to predict rock falls," *E&MJ*, January 1956, pp. 75-77, 103.
6. Hodgson, E. C.: "Rockburst research," *Transactions*, Canadian Institute of Mining and Metallurgy, 1943, Vol. XLVI pp. 313-324.
7. "The theory of rockbursts and the possibilities of geophysical methods in predicting rockbursts, etc." *Journal* Chemical Metallurgical and Mining Society, South Africa, January 1938.
8. Maihak AG., H: "Electronic remote control measuring instruments for mining and tubbing," Hamburg 39, Germany.



LEACHING with a 3% solution of sodium hypochlorite at 80 deg F proved to be the optimum condition for dissolving molybdenum, with 30 minutes contact time.



SIMPLE ion exchange equipment was used in the laboratory by the authors.

An Ion Exchange Approach To Molybdic Oxide

HOWARD COX
A. K. SCHELLINGER

A PROCESS HAS BEEN DEVELOPED at Stanford University's School of Mineral Sciences laboratory, for leaching and ion exchange concentration of molybdenum from low grade ore, copper concentrate or high grade molybdenite concentrate that, in the opinion of the authors, deserves further consideration and pilot plant testing.

Increased importance of molybdenum usage in high temperature alloy applications as evidenced by recent price and demand improvements has resulted in stepped-up interest in the recovery of this element from low grade sources such as porphyritic, or disseminated, copper ores.

Molybdenite content of such deposits may run from 0.01 to 0.02% and is invariably found in the copper concentrate in amounts ranging between 0.5% and 2.0% MoS_2. Flotation methods for recovering over 50% of the molybdenum content of the orebody as a valuable cost-cutting by-product metal have been improved in recent years, but may still involve complexity of operation and high ratios of concentration which in turn are indicative of the shortcoming and costliness of physical separations in this recovery process.

In view of the rapid development of selective and economical hydrometallurgical methods during the past few years, this approach would seem to promise a short cut to greater profits from the valuable by-product metal in many cases. Selective leaching and subsequent concentration by ion exchange has proved to be unusually successful in the economic extraction of important metals such as uranium from low grade ores.

However, regarding the molybdenum content of copper concentrates, and especially of the original ore, as being amenable to extraction by leaching using a low cost selective lixiviant followed by ion exchange concentration of the low grade solution, and precipitation of a pure molybdic oxide, or acid product, seemed to offer an unusually easy route to new profits from conventional molybdenum sources.

Dresher, et al, have recently shown [1] that molybdenite could be leached in an alkaline solution of potassium hydroxide using an oxygen pressure of from 100 to 200 psi at elevated temperatures ranging from 100 to 175 deg C. Under these conditions the molybdenite is oxidized to the molybdate ion which is soluble in the alkaline leach solutions. However, the use of autoclaves is not particularly attractive as a low cost route to higher recoveries.

During the course of a number of investigations aimed at the discovery of a low cost lixiviant, one of the authors discovered that sodium hypochlorite, NaClO, would selectively dissolve molybdenite from other sulphide minerals. No extensive search of the literature was made to discover if this lixiviant had been previously used in this connection.

A unique hydrometallurgical procedure was developed in the laboratory for leaching and ion exchange concentration of the molybdenum from three sources: a low grade (0.015% MoS_2) ore source, a copper concentrate source (1.05% MoS_2), and a high grade molybdenum concentrate source (63% Mo S_2). Elution of the ion exchange resins produced concentrated solutions of molybdenum ions which could be precipitated with nitric acid or by $CaCl_2$, to form very high grade molybdic oxide, and/or calcium molybdate, at total element recoveries ranging from 90 to 99%. No cost estimates were made at this point because it is felt that each

Mr. Cox was a graduate student, School of Mineral Sciences, Stanford University; is now with Ray Mines Division, Kennecott Copper Corp., Hayden, Arizona. Mr. Schellinger is associate professor of mineral engineering, School of Mineral Sciences, Stanford University.

metallurgist will wish to make his own from the following data.

The investigation was divided into three phases. The first was used to determine the characteristics of sodium hypochlorite leaching and to establish the optimum controls for leaching. The second part dealt with the concentration of molybdenum from the leach solution by ion exchange. The third, designated as a unit operation, was used to test the procedure on the basis of the controls established for leaching and ion exchange.

Leaching With Hypochlorite

First phase of this investigation determined the effect of time, temperature and solvent concentration on the leaching rates. These controls were established by running a series of batch tests on a high grade molybdenite concentrate. By varying the leaching time, temperature and solvent concentration, the leaching rates for various conditions were established.

The leaching tests were carried out in a 250-ml beaker containing 1 gram of molybdenite and 200 ml of solution, agitated with a mechanical stirrer operating at 30 rpm. Molybdenite used in these tests was produced by froth flotation using repeated cleanings until the product assayed 99.9% MoS_2. The leaching solution was made by adding varying quantities of NaClO to a stock solution made alkaline to pH 10 with sodium hydroxide.

Leaching rates were determined for five conditions: a 3% sodium hypochlorite solution at 150, 100, and 70 deg F; a 5% solution at 70 deg F; and a 1% solution at 70 deg. Graph indicates the results of these tests. Highest leaching rate occurred with the 3% solution at 150 deg F, where 100% extraction was obtained within four minutes. Decreasing leaching rates occurred with the 3% solution at 100 deg F, the 5% solution at 70 deg F, the 3% solution at 70 deg F, and the 1% solution at 70 deg F, respectively.

The 3% sodium hypochlorite solution at room temperature was selected as the optimum leaching concentration and temperature. Although leaching rates at elevated temperatures were appreciably greater, these conditions would require special equipment which would result in a higher operating cost. The difference in leaching rates between the 3 and 5% solutions did not warrant the use of the higher concentration.

Since the solvent is consumed as the molybdenite is leached, tests were conducted to determine the optimum leaching time for the 3% solution. This revealed that the rate of leaching becomes almost zero after 30 minutes, corresponding to a concentration of 9.1 gpl of MoO_4^-. Consequently, the optimum leaching conditions can be reported as a 3% sodium hypochlorite solution at room temperature with a 30-minute leaching period.

The value of 9.1 gpl of MoO_4^- as a maximum concentration for a 3% sodium hypochlorite solution indicates that the molybdenite is leached in the following manner:

$$7NaClO + MoS_2 + 4e \longrightarrow MoO_4^- + S_2O_3^- + 7NaCl$$

A stoichiometric balance shows a theoretical maximum of 9.26 gpl of MoO_4^- for a 3% solution, which is a reasonable check with the experimental maximum. In addition, a significant amount of the thiosulphate ion ($S_2O_3^-$) was observed when measured by a standard iodine titration. Presence of the thiosulphate ion in oxidation reactions has been reported by Forward, et al, in their work with cobalt and nickel.[2]

Recovery By Ion Exchange

Ion exchange is characterized by three stages: (1) ion adsorption, (2) elution, or removal of the adsorbed ion from the resin, and (3) regeneration of the resin[3]. Using the IRA 400 resin as an example (RzCl being a resin chloride), equations for the three stages can be written as follows:

(1) $2RzCl + Na_2MoO_4 \longrightarrow Rz_2MoO_4 + 2NaCl$

(2) $Rz_2MoO_4 + 2NaOH \longrightarrow 2RzOH + Na_2MoO_4$

(3) $RzOH + HCl \longrightarrow RzCl + H_2O$

In many processes the ions may be of such nature that elution produces regeneration, giving a two-step procedure. In recent years chemists have developed several analytical procedures for concentrating the molybdate ion using ion exchange [4,5]. Four anionic resins were selected for testing on the basis of these results. Resins tested included. Rohm and Haas, Amberlite IRA-400 and IRA-410, and Permutit's S-2 and Deacidite.

Tests were conducted to determine the speed at which the molybdate ion was adsorbed and the maximum amount which could be adsorbed per unit weight of resin. Procedure used was quite similar to that used in the leaching tests. Five grams of resin were gently agitated in a 250-ml beaker containing 200 ml of solution assaying 9.1 gpl of MoO_4. By varying the adsorption time the rates were determined.

Result of these tests are as follows: IRA-400 resin had the fastest adsorbing rate, with IRA-410 showing a slightly lower adsorbing rate. Both of these resins had a maximum capac-

Results on a Low Grade Ore

Product	Amount	MoO_4 (gm)	Distribution (percent)
Eluate	200 ml at 2.89 gpl MoO_4	0.558	93.00
Barren solution	2000 ml at 0.001 gpl MoO_4	0.002	0.33
Preg. soln. (calc.)	2000 ml at 0.029 gpl MoO_4	0.561	93.33
Tails	4000 gm at 0.001% MoS_2	0.004	6.67
Composite head	4000 gm at 0.015% MoS_2	0.600	100.00
Head (actual assay)	4000 gm at 0.0153% MoS_2	0.612	

Results on a Copper Concentrate

Product	Amount	MoO_4 (gm)	Distribution (percent)
Eluate	200 ml at 45.9 gpl MoO_4	9.18	90.58
Barren solution	2000 ml at 0.002 gpl MoO_4	0.004	0.04
Preg. soln. (calc.)	2000 ml at 4.60 gpl MoO_4	9.194	90.62
Tails	990 gm at 0.096% MoS_2	0.95	9.38
Composite head	1000 gm at 1.014% MoS_2	10.13	100.00
Head (actual assay)	1000 gm at 1.015% MoS_2	10.51	

Results on a Molybdenite Concentrate

Product	Amount	MoO_4 (gm)	Distribution (percent)
Eluate	200 ml at 62.8 gpl MoO_4	12.56	99.83
Barren solution	2000 ml at 0.001 gpl MoO_4	0.002	0.16
Preg. soln. (calc.)	2000 ml at 6.28 gpl MoO_4	12.562	99.99
Tails	7.31 gm at 0.017% MoS_2	0.001	0.01
Composite head	20 gm at 62.8% MoS_2	12.56	100.00
Head (actual assay)	20 gm at 63.1% MoS_2	12.62	

ity of slightly more than 0.24 grams of MoO_4 per gram of resin. The S-2 resin had an adsorbing rate somewhat less than IRA-400 and 410 resins with a slightly high capacity. Deacidite showed both a lower adsorbing rate and a lower capacity than the other resins.

IRA-400 resin was selected as the most suitable resin on the basis of rate. The IRA-410 resin probably would be a suitable substitute resin although it has a lower rate.

In order to establish the efficiency of the over-all procedure as an integral process, several unit tests were conducted. Preliminary work in this investigation determined the controls necessary for establishing a working pilot operation for extracting molybdenum. These controls are listed below:

Leaching

Solvent.....3% NaClO solution
Time.....30 minutes
Temperature.....room temperature
Maximum $MoO^{=}_4$ concentration.....9.1 gpl/1

Ion Exchange

Resin.....IRA-400
Resin capacity.....0.24 gm/gm of resin
Exchange time.....6 minutes (minimum)
Eluate.....8% NaOH solution
Regenerant.....1 N HCl solution

These controls were observed as closely as possible in the following tests. As shown in this diagram, the ore was leached by percolating fresh solution from the head tank up through the ore column. Pregnant solution from the ore column overflowed into the ion exchange column where the molybdate ion was stripped from solution.

Three types of feed were tested with this apparatus: (1) an ore containing 0.015% MoS_2, (2) a copper flotation concentrate containing 1.05% MoS_2, and a molybdenite concentrate containing 63.1% MoS_2. In order that the total amount of molybdenite in each test be more equal, starting weights of 4000, 1000, and 20 grams were used for the ore, copper concentrate, and molybdenite concentrate, in that order. These tests were run using identical controls. Each ore was leached with 2000 ml of 3% solution, and a leaching time of 30 minutes using a flow rate of approximately 70 ml per minute.

Molybdate ion was eluted with 200 ml of 8% NaOH solution at a flow rate of 40 ml per minute. Resin was regenerated with 1 N HCl solution as recommended by the manufacturer [7].

Several methods of precipitating the molybdenum from the eluate were tested to determine the purity which could be expected in the final product. Calcium molybdate was produced by adding calcium chloride to the solution, resulting in the following reaction:

$$Na_2MoO_4 + CaCl_2 \rightleftarrows CaMoO_4 + 2NaCl$$

Molybdic acid was produced by the following reaction when the solution was neutralized with nitric acid:

$$Na_2MoO_4 + 2HNO_3 \rightleftarrows MoO_3 + 2NaNO_3 + H_2O$$

Since molybdic acid is slightly soluble in water at pH 7, it was necessary to precipitate the remaining molybdenum with calcium chloride as calcium molybdate, resulting in two products: molybdic acid and calcium molybdate.

The table contains the results of the unit operation test on a low grade ore in a 93.3% extraction with a 93.0% recovery in the eluate. Final eluate was quite low in MoO_4, 2.89 gpl, owing to the small amount of molybdenite available in the ore. Concentration of MoO_4 in the eluate could have been raised to a much higher value by either using a larger amount of ore or a smaller amount of resin.

On the copper concentrate, a 90.6% extraction was realized with a total recovery in the eluate of 90.5%. The eluate in this case contained 45.9 gpl of MoO_4.

On the molybdenite concentrate a 99.9% extraction and 99.8% recovery were obtained. Eluate contained 62.4 gpl of MoO_4.

Best recovery was obtained on the molybdenite concentrate, and was probably due to the smaller amount of feed used in this test. The starting material weighed only 20 grams; consequently, the bed was quite loose and allowed free circulation of the solvent. Tests run on the ore and copper concentrates used large volumes of feed which resulted in tight beds and restriction of the flow of solution.

Precipitation of the MoO_4 from the eluate with calcium chloride resulted in a very satisfactory product —a product containing 99.8% $CaMoO_4$ with a total recovery of 100%. This procedure is quite positive and has been used in industry extensively. [8]

Precipitation of the MoO_4 with nitric acid resulted in two products: molybdic acid precipitated directly, and calcium molybdate precipitated by the calcium chloride added as a scavenger. The results of this test are:

Product	Grade	Recovery
Molybdic acid	99.9% MoO_3	90.16%
Calcium molybdate	98.7% $CaMoO_4$	9.84%

The precipitation tests were run largely to check the purity of the final product. Precipitation of the MoO_4 by calcium chloride is so positive that this reagent is frequently used in analytical work.

Thus the over-all results of the unit operation tests were quite encouraging. These tests demonstrated that good recovery with a high purity end product can be obtained from leaching heads ranging from 0.015 to 63% MoS_2.

Acknowledgment and thanks are due to Kennecott Copper Corp., for furnishing ore and other material help to the Mineral Processing Laboratories at Stanford prior to and during the course of the foregoing investigations, and to Rohm & Haas Co., and the Permutit Co., Div. of Pfaudler-Permutit, Inc. for resin samples and literature used in part of the investigations.

References

(1) Dresher, W. H. *et al: Mining Engineering*, Vol. 8, p 743.
(2) Forward, F. A.: *Mining Engineering*, Vol. 191, p 577.
(3) Mindler, A. B.: *Engineering and Mining Journal*, Vol. 150, p 102.
(4) Fisher, S. A.: *Analytical Chemistry*, Vol. 24, p 1100.
(5) Melocke, V. W.: *Analytical Chemistry*, Vol. 26, p 1911.
(6) Ayres, G. H.: *Analytical Chemistry*, Vol. 23, p 304.
(7) Rohm and Haas: *Amberlite IRA 400*.
(8) Johnstone, S. J.: *Minerals for Chemical and Allied Industries*, John Wiley and Son Inc., 1954.

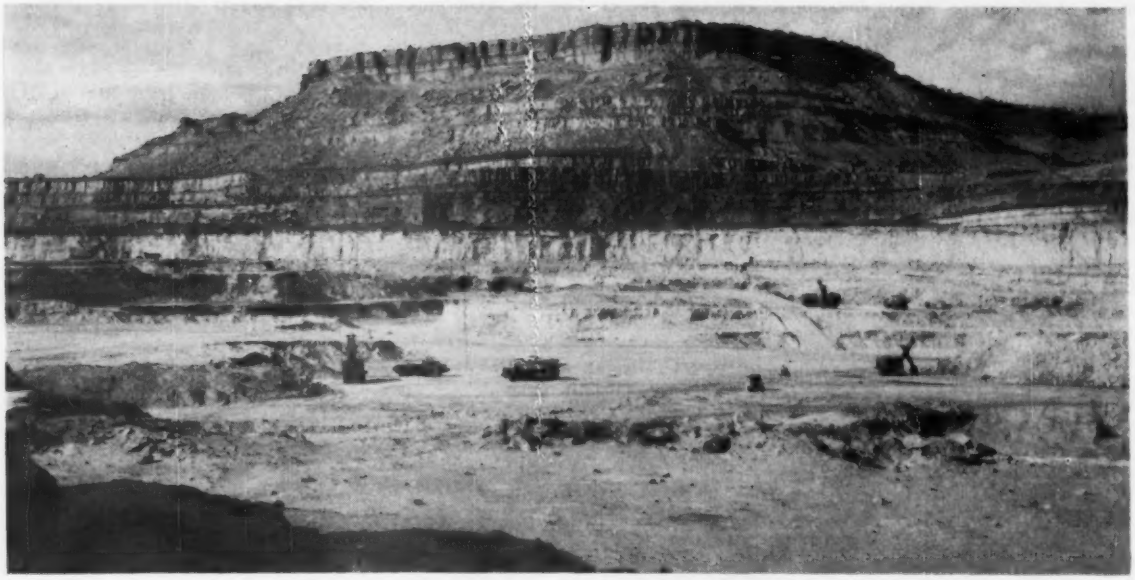
Bicroft Develops Electronic Rock Sorter

TWO EMPLOYEES at Bicroft Uranium Mines Ltd., Bancroft, Ont., have developed and put to use an amazingly efficient waste rock eliminator known as the K&H Electronic Sorter, according to the *Northern Miner*.

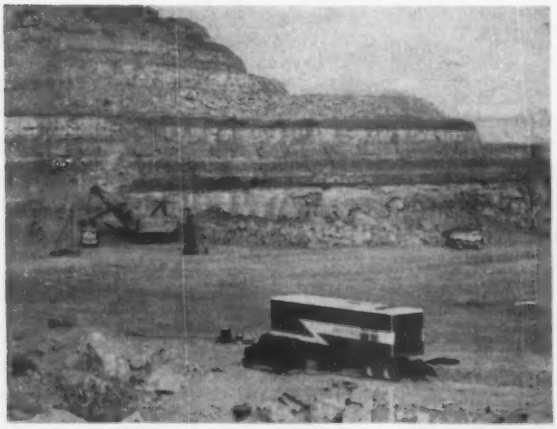
Based on limited testing of plus 3-in. rock, the Sorter is expected to remove some 200 tpd of waste from the mill feed—a two-way saving—raising the pounds-uranium-processed capacity of the mill; and cutting grinding and reagent costs.

Some estimates place the value to Bicroft at $400 a day in milling costs; savings would be higher at mills having higher acid consumption per ton of mill feed. No decision has been made as yet as to the possibilities of marketing the device. The Sorter can be used to upgrade gold ore as well as uranium, and its possibilities as regards magnetic ores is being checked.

J. Kelly, chief geologist and J. F. Hutter, chief engineer, developed the K&H Electronic Sorter.



BEGINNING of the complex Anaconda operation near Grants is the Jackpile mine itself, discovered by aerial reconnaissance in late 1951. Some 33,000 ft of exploration drilling and three development tunnels outlined the major orebody.

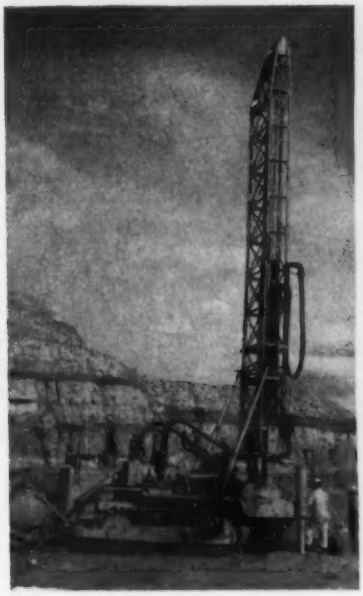


MOBILE POWER PLANT is diesel-powered, trailer-mounted. The General Electric model MH (500 kw) powers the shovels.

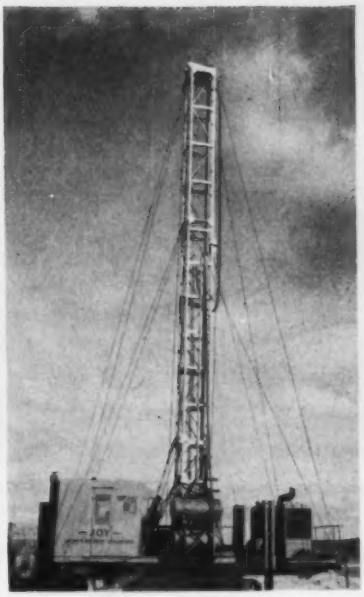
SAMPLING OF LOADS takes place right in the pit. Operator takes readings with geiger counter, determines final dump site.

PIT TRUCKS dump into 100-ton feed bin after sampling. A 42x48-in. Pioneer primary jaw crusher receives the ore load.

MORE PRECISE CHECKING comes from use of the electronic ore grade control instrument, set up on the conveyor belt.



PRIMARY blastholes in waste benches are put down with 6¾-in. rotary drills.



BLASTHOLES in the stripping area run 7⅞-in. dia; rigs are crawler-mounted.

SHOVELS are both electric and diesel, Euclid 22T's haul ore and waste from pit.

The Jackpile Mine—Revisited

JOHN B. HUTTL

IN THE SPRING OF 1954, when *E&MJ* first visited the Grants-Bluewater area in northwestern New Mexico, Anaconda Co. had been operating its new carbonate leach plant at Bluewater for several months and was actively developing the famous Jackpile mine in Valencia County.

Security regulations at that time prevented much of the story from appearing in the article which ran in the August 1954 issue. But, with the relaxed regulations now in force, the property can be described in full.

The Jackpile-Bluewater story, with emphasis on mining and Anaconda's careful mill-feed technique, along with the mill method, is the basis for this article, the result of a visit in March of this year to finally get, and publish, the full story.

Finding the Mine

The Jackpile mine was discovered in November 1951 by aerial reconnaissance started by the company in 1950, employing scintillation equipment. It is situated on the Laguna Indian Reservation near the village of Paguate and some 45 miles east of Grants. Access by car is afforded via an eight-mile gravel road branching off U.S. Highway 66 at the Pueblo of Laguna. Rail facilities consist of a spur five miles long, built by the company and connecting with the Santa Fe R.R. main line near Laguna.

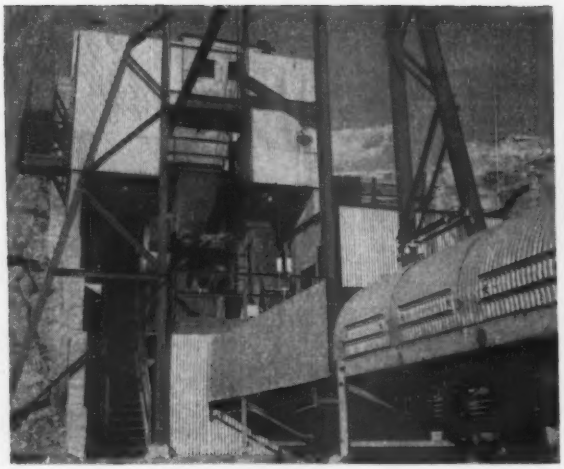
The outcrop found by the airborne crew measured only 20x50 ft in size. Initial exploratory drilling, totaling some 33,000 ft, disclosed a large orebody with a thickness ranging from a few to as much as 50 ft. Overburden averaged 110 ft. The ore proper is in the Westwater sandstone of the Morrison formation of Jurassic age. It occurs in irregular, tabular lenses of medium-grained, carbonaceous sandstone, ranging in color from yellowish-gray to black. A large diabase sill cuts the Jackpile orebody.

A comprehensive underground program was initiated after close of the exploratory drilling campaign to check collected drilling information. This consisted of driving three tunnels, with cross sections large enough to permit use of a 1¼-yd tractor loader for handling broken material, in strategic locations. One was advanced in the ore zone proper and the other two about 30 ft below it with certain drill holes for targets. When these had been reached, raises were established through the ore. Material obtained from development was shipped in its entirety, as bulk samples, to the plant at Bluewater where it was mechanically sampled, assayed and metallurgically tested. All raises were blanket sampled and mapped geologically. The figures obtained at Bluewater checked closely with the information collected during previous diamond and rotary exploration drilling. The underground work also furnished essential data on water conditions, ground characteristics, ground support required, etc.

Choosing the Method

Although the waste-ore ratio was estimated at 8:1, decision fell on open pit mining. It was calculated that about 20% more ore could be recovered by open pit methods and a high degree of selective mining carried on with the possibility that unknown ore would be discovered during actual mining. Also, the topography of the ground area covering the deposit lent itself well to pit operation.

The present Jackpile pit is the outgrowth of two separate mining operations, with the first started in the latter part of 1953. Isbell Construction Co. then was awarded a contract for stripping overburden down to within 20 to 25 ft of the developed ore zone, followed by Anaconda removing the remaining overburden and subsequently mining the exposed ore. The second operation was started during the first part of 1955 and involved removal of



GOOD VALUE ORE is crushed to shipping size in the jaw crusher and dropped to the belt. Design was by Anaconda.

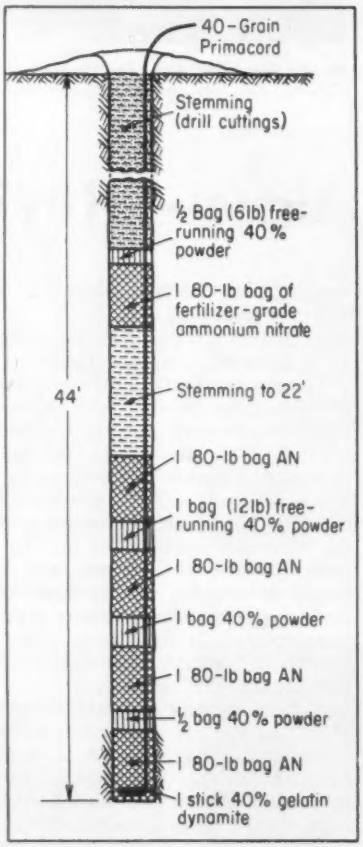
INCLINED 48-IN. BELT, covered with aluminum sheet, transports the crushed ore to the loading station for the trip to plant.

some 15-million tons of overburden covering an exceptionally large orebody north of that prepared for mining in 1953. Isbell Construction, who was again the contractor, finished the work in October 1956, with all stripping thereafter being done by Anaconda. The total amount of overburden removed to date exceeds 36-million tons, most of which required blasting.

The pit proper is roughly rectangular in shape. Width and length average 1,600 ft and 3,000 ft, respectively. Benches in the stripping zones are carried at heights ranging from 30 to 40 ft and those in the ore, low grade and associated waste zones from 10 to 30 ft, depending on the character of the ground mined.

Blastholes are drilled exclusively with rotary drills. Equipment available includes a Joy Heavy Weight Champion using 7⅞-in. Tricone-type Portadrill with 6¾-in. Tricone-type bits; and three Failing rotaries using 4¾-in. Tricone-type bits in hard sandstone and drag or finger bits of like size in soft ground.

Primary blastholes are drilled 4 ft below grade. Drill hole patterns used in the stripping zones and ore zones vary, and the number of holes and spacing are determined after study of the ground to be blasted, or by the particular shovel the drill operator is drilling for. Blasting is done with fertilizer-grade, prilled ammonium nitrate, which is received in 80-lb bags. Each bag receives about 1 gal of diesel fuel prior to being emptied into the hole. Distribution of the powder load and position of stemming and primer in each hole are shown in the accompanying sketch. Loaded holes are detonated with 40-gr Primacord. The main Primacord line has 9 millisecond delays between each hole. Powder factor averages 3 lb per ton blasted.


40-Grain Primacord
Stemming (drill cuttings)
½ Bag (6lb) free-running 40% powder
1 80-lb bag of fertilizer-grade ammonium nitrate
44'
Stemming to 22'
1 80-lb bag AN
1 bag (12lb) free-running 40% powder
1 80-lb bag AN
1 bag 40% powder
1 80-lb bag AN
½ bag 40% powder
1 80-lb bag AN
1 stick 40% gelatin dynamite

FERTILIZER grade, prilled ammonium nitrate is blasting agent at Jackpile.

Materials removed currently from the pit include 3,460 tpd ore; 6,700 tpd low grade material and waste; and 30,980 tpd overburden, or a total of 41,140 tpd. The following equipment is available to move the tonnage:

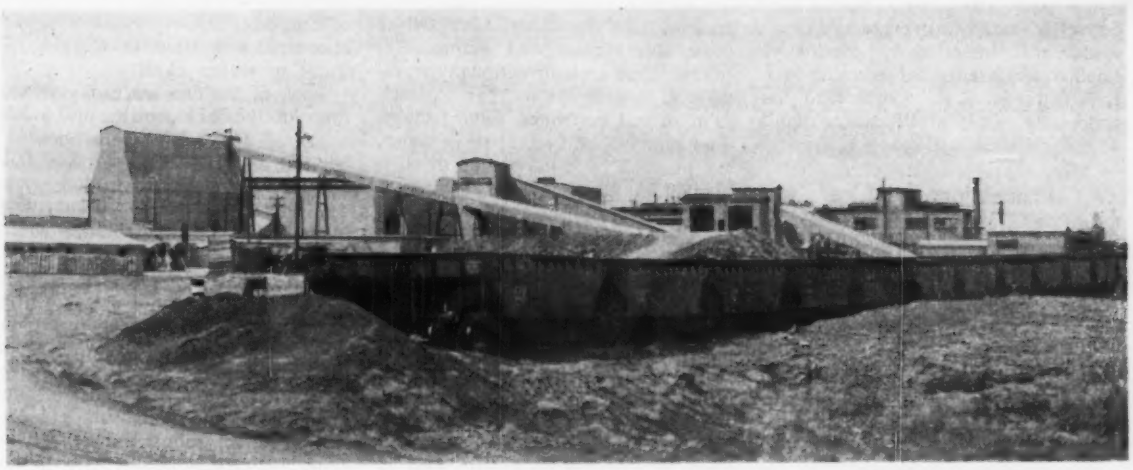
Shovels: One 6-yd P&H 1600 electric; 5-yd P&H 1500 electric; 3-yd B-E 71-B diesel; 2½-yd Koehring 1005 diesel; 1½-yd Koehring diesel; 1½-yd B-E 38-13 diesel; and a ¾-yd Koehring 605 diesel. The two large electric shovels are used in the stripping zones, with power furnished by two 500-kw G.E. trailer-mounted, diesel-powered Model MH mobile power plants. Save for the ¾-yd Koehring shovel, which is used for clean-up work, all other diesel-powered units are used in the ore and waste zones.

Trucks: Equipment on primary haulage consists of 27 Euclid 63TD and 36TD trucks, all of 22-ton capacity. Auxiliary units include welding, grease, sprinkler, and fuel trucks, crane, road graders, three Caterpillar D8 tractors, A-C HD5 tractor, and an A-C HD9 front end loader. To service the shovel, drill, primary and auxiliary haulage units, the company maintains well-equipped repair shops at a central point in the pit area. The buildings are of prefabricated steel construction.

All main haulage roads are established at grade of 2% or below. Frequent blading and sprinkling of the 45-ft wide road surfaces keeps tire wear and over-all truck maintenance costs at a minimum. Haulage distances vary from one-half to 1½ miles.

Controlling the Feed

To provide a fairly uniform feed for the processing plants at Bluewater, an elaborate and interesting sampling and ore control system has been instituted at the pit. In addition, stockpiles of ore of varying grade are main-



THE LOADED ORE TRAIN, from the Jackpile is moved alongside the Bluewater mill. Treatment is by carbonate leach (600 tpd) and acid leach (2400 tpd). Latest revamping of the mill, located about 45 miles from the mine, took place in 1956.

tained for blending. Material assaying 0.25% U_3O_8 or more, is considered straight shipping ore. Waste is any material containing 0.02% U_3O_8 or less.

Long range planning, as to ore grade, is based upon sample results from development diamond-drill holes spaced 100 ft apart on 200-ft sections. As the stripping benches are moved back, supplemental drilling is employed, closing the drilling pattern into a 50-ft grid with occasional 25-ft spacing being established in zones of sporadic values or areas of inconsistency. Samples from the latter drilling are broken at 2-ft intervals and assayed radiometrically in most instances.

Based upon the information thus obtained, mining benches in the mineralized horizons are planned and established. As operations progress, these faces are drilled with small rotary drills for sampling and blasting purposes. Spacing and depth of holes vary considerably according to the type of ground and height of the working face. However, the average spacing is about 8 ft. The 4¾-in holes are sampled from collar to the bottom of the ore, with information governing the cut-off point of the sample being obtained by frequent probings with a geiger counter. Holes are continued after the sample is completed for a distance of 4 to 8 ft in order to give conclusive data as to the mineralized horizon and to allow for some subgrade blasting.

Each round is examined by the ore control engineer. The holes are marked as to depth of blasting and are stemmed back for that purpose allowing for a minimum of dilution. A plan sketch is made of the round on which is placed the position of each hole identified by its sample number. Assay results are studied and are posted on the sketch by using a color code which groups the values into certain ranges. The tonnage, grade and classification of the blast in its entirety or in zones is calculated, with results being placed on a master plan.

In the event that the round can be zoned as to various grades of sufficient tonnage to allow mining segregation, the areas are staked out and marked on the muckpile after blasting. Guided by the information thus obtained, the blasted material is moved by power shovel and trucks to various locations, depending on the following classifications: (1) Material suited for direct loading into railroad cars; (2) material of shipping grade designated for surge stockpiles in the pit; (3) material of low grade and spotty nature which must be segregated by probing and sampling into various categories for movement to stockpiles of different grades; and (4) waste.

Additional control as to the grade of ore shipped to the mills is obtained during the loading operation. An Ore Grade Control Instrument engineered and built by the Eberline Instrument Corp. of Santa Fe, N.M., is installed in the crusher house at the entrance of the pit with the detection head situated under the belt carrying the crushed ore to the railroad cars. Radiometric impulses of the material as it passes over the head are measured and transmitted to the counter recording the number of impulses per minute. By taking the time interval for loading into account, deducting the background count, and applying a factor which converts the resulting net counts into radiometric value of the ore, information is obtained as to the estimated assay value of the material in each car immediately after the loading. If the grade is not within the required range, the ore control engineer can move shovels into different ore faces, effect a loading blend at the hopper, or otherwise take steps to remedy the situation.

At the end of each loading shift, the mill is notified in advance as to the assay value and tonnage in each car.

The primary crushing plant near the main pit entrance consists of an 80-ton receiving bin with a 48-in. Pioneer feeder unit at the bottom, 42x48-in. Pioneer Model J jaw crusher, and a slightly inclined 48-in. covered belt conveyor operating between the crusher and the car loading plant. Here are crushed to specified size all straight shipping ore and blended ore trucked from the pit prior to being loaded into 70-ton gondola-type cars. All crushing and loading operations are controlled from a central room above the crusher in which are installed the different devices controlling the feeder, crusher proper, loading

Metallurgical Data Covering Acid-Leach Mill

Milling rate, tons per day	2,800
Grind	20% + 48 mesh
	15% − 325 mesh
Rod mill discharge, % solids	70
Rod consumption, lb steel/ton	0.20
Leach density, % solids	60
Leach acidity pH	1.1
Ratio vol. tons H_2O/dry tons ore	2.33
Ion exchange feed pH	1.8
Adsorption retention time, minutes	110
Elution retention time, minutes	550
Elution bed volumes, cubic ft	15
Elutions per day	12–13
Percent over-all recovery	90

conveyor, and the ore grade control instrument mentioned previously. Loaded cars are hauled in trains over the Santa Fe R.R. mainline to the processing plants at Bluewater about 45 miles distant.

Processing the Ore

Milling facilities have been greatly expanded since establishment of the first carbonate leach plant in 1953. Capacity of this unit, which currently treats limestone ores from the company's Section 9 and Section 33 properties, Haystack mine of Santa Fe, some Jackpile material, and contracted ores from independent shippers, has been increased to 700 tpd. The work completed in March 1955 included addition of a second 5½x12-ft rod mill in the grinding circuit and a new continuous-leaching and Oliver filtration section involving installation of three 18-ft drum filters and auxiliary equipment. Revamping and enlargement of the existing crushing plant to take care of the increased tonnage demand was completed in late March 1956. Included were complete cross-over arrangements between it and the crushing plant serving the new acid leach plant, providing bypass flexibility of operation in the crushing and disposition of ores to the bins of each mill or to the stockpile.

Construction of the completely integrated crushing, grinding, acid leaching, and RIP mill was started in the fall of 1954. The first section went into operation Dec. 5, 1955, and the second early in January 1956. The plant has a capacity of 2,800 tpd and handles Jackpile ore exclusively. Auxiliary plant units installed during the expansion period include a new car unloading arrangement at the head of the crushing plants, and a nominal 75-ton contact sulphuric acid plant to furnish acid for the acid leach plant, using molten sulphur or Texas brimstone. The water supply system has been enlarged, as have been the repair shops, warehouse, office and company settlement near the plant, including employee recreational facilities.

The flowsheet employed in the carbonate leach plant follows more or less standard practice. Treatment involved grinding to about 25% plus 65 mesh and 40% minus 200 mesh on hot recycle carbonate-bicarbonate solution in a rod mill-cyclone circuit, followed by leaching in two sections of six sweep-agitated autoclaves in series at 250 deg F and 30 psi pressure, with MgO as additive reagent. After flashing the hot leached pulp to atmospheric pressure in airlift agitator tanks, it is pumped in batches to five 5x40-ft Burt pressure filters and continuously to the three 18-ft Oliver drum filters mentioned before. Resultant cakes are conventionally washed with recycle filtrate, barren leach solution and hot water. Final tailings, after sampling and repulping in water, are pumped by 6-in. pumps through parallel but alternate 4-in. pipelines to a sump which also receives tailings from the acid leach plant 2600 ft distant (these constitute tailings from the Burt and Oliver sections, with each being pumped separately). From the sump the mixed tailings are pumped 2500 ft by 8x10-in. pumps through parallel but alternate 12-in. woodstave pipelines to a disposal basin.

Pregnant solution produced in the carbonate leaching section is precipitated by addition of caustic soda in excess, and the precipitated sodium diuranate recovered in plate-and-frame filter presses. Barren filtrate is regenerated by carbonation using flue gas from the plant steam boilers and boiler serving the power plant.

Treatment of Jackpile sandstone ore in the acid leach plant involves grinding the ½-in. feed to 15 to 25% plus 48 mesh and 15% minus 325 mesh in water in rod mills. The product from the grinding section is then leached in a series of 18 neoprene-lined 13x14-ft agitators with neoprene-covered ship-type propellers. Feed to the leach section contains 60% solids. Sulphuric acid is stage fed to the first eight agitators, the quantity being carefully controlled and checked for each tank. These units also receive minus 300 mesh manganese dioxide which is dry fed into the top of each tank by Denver Equipment Co. feeders.

Sand and slime of the leached pulp are separated in rake classifiers and cyclone units. The sand fraction is washed counter-currently and sent directly to the sump mentioned previously. The 8-in. parallel but alternate pipelines through which it is pumped by 6x8-in. pumps are neoprene-lined and 3200 ft long. New equipment installed recently in the sand washing section to effect additional removal of sands from the RIP plant feed are two washing units, each consisting of 26 Krebs 4-in. cyclones in three stages. The low solids, all minus 325-mesh slime fraction separated as a suspension in the pregnant liquor of the leach is adjusted to proper pH and emf potential for ion exchange extraction of the uranium oxide by the RIP process.

The uranium is extracted from the solution of the pulp by ion exchange on strong base anion resin. The resin is held in 4-ft cubical baskets following the Walker-Lybarger design. These consist of a welded framework of Carpenter 20Cb stainless steel panel-covered with Hastelloy-C Tyler 147 Ton-Cap screen cloth.

Each of the two ion exchange sections of the mill consists of 14 RIP banks of 10 baskets, with about 15 cubic ft of wet settled resin contained in every basket on the loading cycle. The baskets are moved up and down in the pulp or eluting solution within cell-like baffling.

Currently, nine banks are used for loading or extraction of uranium from the pulp, while five banks are on elution for the removal of uranium on the resin. Final and secondary, or recirculation products of ion exchange are collected in four sumps below floor level for subsequent delivery to respective process points. After partial neutralization with lime, the pregnant eluate is clarified in plate-and-frame presses. The clarified solution is then neutralized with magnesium oxide to effect precipitation of the uranium as a diuranate. Precipitated neutral solution is pumped to plate-and-frame presses in the yellow cake section of the mill for recovery of the uranium precipitate. The barren solution is returned for make-up of new eluting solution. Slime tailings from RIP treatment are pumped back to the grinding-leaching-classification section of the mill where they are used in each section of the mill for dilution of the respective classifiers sand tailing after automatic sampling.

Filtration of uranium precipitates, and drying, packaging and shipment of yellow cake are carried out in a separate security area which serves both mills. Process employed for the carbonate yellow cake is distinct from that for acid yellow cake. Filter cake is thick-pulped and dried on double-drum steam dryers discharging directly to the shipping drum through pant-leg chutes and dust closures. Dust collecting systems are available in the packing areas and on the dryers. A modern change room, laundry, and lunch room are maintained in the security area.

A. J. Fitch, manager, directs the New Mexico operations of the Anaconda Co. He is assisted by E. C. Peterson, assistant manager.

The operating personnel at the Jackpile mine include J. P. Herndon, mine superintendent; F. J. Balentine, assistant mine superintendent; B. F. Barlow, general pit foreman; and R. B. Schlosser, production engineer, R. D. Lynn, with headquarters at Bluewater, is chief geologist.

At Bluewater the principal supervisors are D. C. Matthews, chief metallurgist; W. J. Roberts, general mill superintendent; and J. R. Pate, chief chemist.

Comparison of Results Obtained by Grain-Count and Heavy-Liquid Methods

Method	Standard sample of mica 4	8	13	23	78	82	92
Heavy liquid							
Analyst A	5	8	12	21	78	79	92
Deviation from standard	+25.0%	zero	− 7.7%	− 8.7%	zero	− 3.7%	zero
Analyst B	3	9	12	21	78	79	91
Deviation from standard	−25.0%	+12.5%	− 7.7%	− 8.7%	zero	− 3.7%	− 1.1%
Heavy liquid corrected							
Analyst A	4	11	14	21	78	80	91
Deviation from standard	zero	+37.5%	+ 7.7%	− 8.7%	zero	− 2.5%	− 1.1%
Grain count							
Analyst A	1	4	13	17	83	63	80
Deviation from standard	−75.0%	−50.0%	zero	−26.1%	+ 6.4%	−23.2%	−13.0%
Analyst B	5	10	15	25	90	85	95
Deviation from standard	+25.0%	+25.0%	+15.4%	+ 8.7%	+15.4%	+ 3.7%	+ 3.3%

How to Determine Mica Content

C. JOSEPH VENUTO

THE DETERMINATION of the mica content of ore and mill samples has always presented a difficult problem to millmen and laboratory personnel. Mica, because of its excellent basal cleavage, splits into grains varying widely in thickness. In addition to this characteristic, mica is frequently difficult to distinguish from other minerals in fine grained (minus 100 mesh) fractions. These are the principal reasons why the application of the grain count method, commonly used to determine mineral percentages, has proved inadequate for this mineral.

To be of practical value to millmen, a method for mica determination, in addition to being accurate, must be:

(1) Rapid—so that necessary adjustments in the mill circuit can be made with a minimum loss of time.

(2) Simple—so that men of technician grade can carry out the method as a routine procedure.

The grain count and heavy liquid methods of mica determination were tried. The grain count method was rejected because it did not satisfactorily meet the requirements listed above.

Heavy Liquid Method

The heavy liquid method has been known and widely used for many years. Heavy liquids such as bromoform (sp gr 2.84), tetrabromoethane (sp gr 2.95) and methylene iodide (sp gr 3.32) are commonly used to separate various mineral species from each other. Minerals having a lower specific gravity than the liquid will float and those having a higher specific gravity will sink. By proper dilution of the heavy liquid, minerals of different specific gravities can be successively separated from each other.

To assure clean separations by this method, certain basic requirements must be met.

(1) The identification of the various minerals present in sample must be known so that appropriate specific gravity adjustments of the heavy liquid can be made.

(2) The mineral to be separated must be liberated from the other species present.

(3) The specific gravity of the mineral to be separated must not be too close to that of the other species present.

The heavy liquid method, with suitable modifications, was applied to the determination of the percent mica in the mill fractions of a spodumene pegmatite ore. The ore contained potash and plagioclase feldspar (in approximately equal proportions), spodumene, muscovite mica and trace amounts of heavy accessory minerals. The method is presented below in detailed outline form for convenience.

Materials and Apparatus

Tetrabromoethane
Kerosene
Acetone
Centrifuge tubes
Filter paper
Hydrometer[1]
Filter assembly

Solutions

Tetrabromoethane[2]
sp gr 2.95 ± 0.005
Terabromoethane + kerosene
sp gr 2.72 ± 0.005

Dilute tetrabromoethane with kerosene until the solution has a specific gravity of 2.72 ± 0.005. Its specific gravity should be checked before each separation. Tetrabromoethane solutions oxidize and become dark with continued use. They may be cleared up by the addition of approximately 100 grams of Fuller's earth per half gallon of solution. This is stirred well and filtered and the clear solution claimed for reuse.

Procedure

(1) Stage crush representative samples of the mill fractions to be examined to liberation size and mix well.

(2) Weigh out 2.00 ± 0.01 g of each sample in duplicate, transfer to centrifuge tube containing heavy liquid of 2.95 specific gravity. Mix thoroughly and centrifuge in head operated centrifuge at about 600 rpm. (Do not greatly exceed this speed or tubes will be broken.)

(3) Remove tubes from centrifuge. Stir float fraction thoroughly (without disturbing sinks). Centrifuge again for two minutes.

(4) Repeat step (3) once again.

(5) Stir up floats without disturbing sinks and pour off heavy liquid containing bulk of floats onto heavy liquid recovery filter assembly. The floats will contain mica, feldspar and quartz.

(6) Add fresh heavy liquid to tube containing the sink fraction. Mix thoroughly by shaking. Centrifuge again for two minutes. Pour off heavy liquid and small amount of float fraction present onto heavy liquid filter.

This work was done when the author was research mineralogist with the Foote Mineral Co., Berwyn, Pa.

[1]Specially made by Philadelphia Hydrometer Co., 1671 Ruffner St., Philadelphia, Pa. Sp gr Range 2.500 to 3.000. Smallest graduations = 0.005.

[2]Tetrabromoethane is toxic. Operations involving the use of this liquid should be carried out in a well ventilated hood.

(7) Add fresh heavy liquid to tube and suspend sink fraction again by shaking. Transfer sinks and heavy liquid onto a clean filter paper in a conical glass funnel. Wash residual sinks from tube by rinsing with fresh heavy liquid. Filter off sinks with suction. Recover heavy liquid for future rinse. The sinks will contain spodumene and a very small percent of heavy minerals.

(8) Wash sink fraction with minimum amount of acetone (acetone containing heavy liquid can be used for first wash; final wash should be with fresh acetone). Recover acetone wash solution. Evaporate at room temperature to recover heavy liquid.

(9) Dry and weigh sink fraction to the nearest milligram.

(10) Take floats from each of duplicate samples and repeat steps 1 through 9 using a mixture of tetrabromoethane diluted with kerosene to lower its specific gravity of 2.72. The sinks in this liquid will be the mica portion of the sample. The mica sink fraction should be checked with the binocular microscope for cleanness of separation.

(11) The weight percent of mica is then calculated for the entire sample.

This method was compared with the grain count method for accuracy, analytical time per sample and simplicity of routing operating procedure.

A series of six samples containing carefully weighed amounts of hand picked ground mica in a selected matrix of feldspar, quartz and spodumene were set up. Duplicate sets were split out of the original samples and submitted for examination to different analysts using both the heavy liquid procedure outlined above and grain count method. In the latter method, each sample was screened at 40, 60, 100 and 150 mesh. Each fraction was then examined by two separate analysts under a binocular or petrographic microscope and estimates of the percent mica present were made. All analysts were familiar with mica and its properties and skilled in its recognition. The results obtained by both methods are presented in the accompanying table for comparison.

Methods Compared

It can be readily seen that the heavy-liquid method produces more accurate and consistent results than the grain count method.

A combination of the two methods was tried by analyst A. Corrections were made for impurities in the sink fractions by grain counts with the petrographic microscope. The results are listed in the last two columns of the table. They indicate that a combination of the methods does not improve accuracy. The composite method also has the disadvantage of requiring additional time and an analyst skilled in its tools.

The heavy liquid method was found to be comparatively rapid compared with other methods. It was found that a moderately skilled technician starting with the prepared sample can analyze a dozen samples an hour. This can be compared with a rate of two to three samples per hour by the grain count method. The amount of analytical time per sample will, of course, vary with the skill of the individual analyst. For any two equally trained analysts, however, the time advantage will always be with the man using the heavy-liquid method. An additional and very important factor to be considered is that the latter method is much less tedious on the analyst than grain counting. As a result, the personal error factor does not reach serious proportions toward the end of the working day.

The simplicity, speed and degree of accuracy obtained in laboratory tests using the heavy-liquid method has been fully substantiated in actual mill practice. It has yielded excellent results and is now employed as a routine control method.

Postscript to the Rainier Blast

TWO PRINCIPAL QUESTIONS have been asked by *E&MJ's* readers concerning the report on the underground atomic shot ("Rainier Blast Opens New Horizons," by G. W. Johnson in *E&MJ*, April 1958, p 21). The questions and Dr. Johnson's answers are as follows:

1. What is the rate of decay of the radioactivity? ". . . the level drops off according to the following law: $I_t = I_t t^{-1.2}$. As you can easily verify, this law provides that the intensity decreases by a factor of 10 for every 7-fold increase in time."

2. How dangerous to human life is the radiation shown in the graph? ". . . the median lethal dose if administered for a short period of time is about 400 roentgens. For continuous operation the AEC considers it safe to absorb 300 milliroentgens or 0.3 roentgens per week."

From these answers, *E&MJ* calculated that it would take almost 11 years for the radiation to drop to a level (300 mr per wk, which *E&MJ* calculates as 7.5 mr per hr for a 40-hour week) where mining could be continuously conducted in the hemispherical shell between 40 and 70 ft radius from the shot-point (which drillhole probes indicated as averaging roughly 400 mr per hr at 20 weeks post-shot). *E&MJ*'s calculation was:

$t = (I_o/I_t)^{1/1.2} = (400/7.5)^{0.833} = 27.5$

and 27.5 x 20 wks = 550 wks or 10.6 yr.

But, to this Dr. Johnson replied: "The 400 mr per hour level that you quoted was measured with a probe in a drillhole, and this field would be higher than an individual would be exposed to except in the radioactive zone itself. The earth itself is a very effective shield and, in fact, one foot of material will reduce the radiation level by a factor of at least 20. So by controlling the amount of exposed material and by appropriate use of sand bags, mining can be carried out without undue hazard. For example, we now have the tunnel completed up to the face of the original spherical cavity produced by the explosion. We are digging pieces of the radioactive material out by hand without any special radiation protection. The radiation levels right against the face are as expected, about 300 mr per hour. Standing back three feet from the face the level is 20 mr. An average exposure that one might expect in digging the material out by hand, as we were doing, would average about 50 mr per hour, which means that a man could work in this position only six hours a week. However, by erecting a simple barrier and using standard mining equipment, the stand-off distances would be such that the radiation levels would be down to background levels.

"We are starting now to drive the tunnel into the center of the original cavity. On completion of this tunnel we will probe vertically downward to obtain more detailed information on the nature of the Rainier debris. In the bottom of the region we expect to get much higher levels of activity and therefore will need to incorporate more precautions into our mining procedures."

As a sequel to the original report and these letters, Dr. Johnson will describe new results in *E&MJ* as they become available.

Broken Hill Tries Long-Hole Drilling

EXTREMELY LOW COST ore extraction is being carried on via long-hole drilling at Zinc Corporation Ltd.'s lead-zinc mine at Broken Hill, Australia, where a 50,000-ton orebody was taken down, 2,000 tons per shot.

Zinc Corp. introduced shrinkage stoping to its operations some time ago (*E&MJ*, June 1956, p 95), but this is the first experience with the long-hole method.

The long-hole shrinkage stope is situated in the siliceous zinc lode at the northern end of the No. 5 level, and contains about 50,000 tons of ore assaying 4% lead, 10% zinc and showing one ounce of silver to the ton. The stope is 120 ft long and varies in width from 35 ft on the No. 5 level to 12 ft on the No. 4. The stope at completion of mining was expected to be about 210 ft high.

Prior to long-hole drilling, 12 ft of hydraulic fill was placed in the then 16-ft sill stope. Draw points were cut at 25 ft intervals off the haulageway and broken through after the fill was laid. The draw point track work is set 11 in. above the main haulage line to permit a turntable transfer trolley to move the car loader from one draw point to another. (*E&MJ*, June '56)

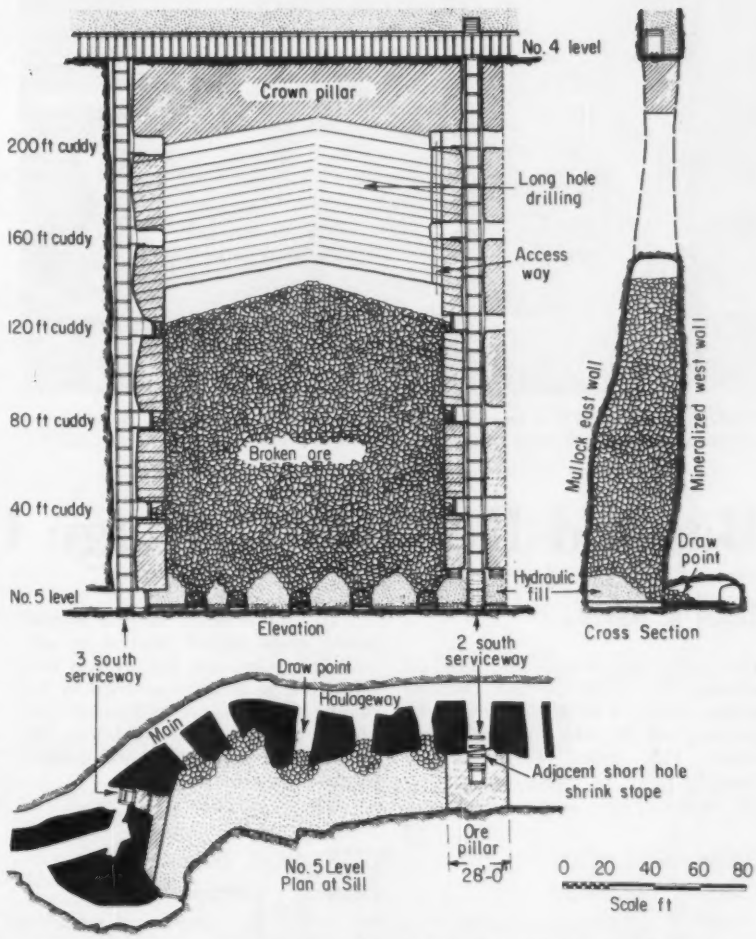
The 16-ft stope was heightened to 26 ft by shrinkage methods before initiation of long-hole drilling at 30 ft.

In long-hole drilling at Broken Hill, holes fan out from 3S and 2S winzes in the pillar. Zinc Corp. used 4-in. drifters, 4-ft coupled 1-in. hexagon extension rods, 1¾-in. OD couplings and bit adaptors and 2-in. tungsten carbide tipped detachable bits. Average penetration was about 100 ft per shift, with drilling kept well ahead of blasting.

Ore limits were determined by diamond drilling from the "cuddies" in each ladderway. Long-hole layouts were designed to give 10 ft spacing and 4 ft burden at the toe of the holes, which were drilled at an elevation of 10 degrees.

One aim in keeping the drilling well ahead of the firings was to ensure that access ways for inspection purposes could be raised between cuddies at the No. 2 South Serviceway (see drawing).

Holes were charged with 1½-in. AN60 gelignite after blowing out with ½-in. dia plastic hose. Sashcord threaded, 2-ft-long, wooden tamping sticks were used to charge the holes, which were stemmed with clay to the pillar line. Two electric millisecond delay detonators were used in each hole.



GOOD FRAGMENTATION after long-hole drilling and blasting has permitted Zinc Corporation Ltd. of Broken Hill, Australia to mine a 50,000-ton lead-zinc orebody by the safest and most economical method yet employed. Cut and fill has been the usual method of extraction, but shrinkage stoping has also been used.

Usual blasting method consisted of two rows from each winze, fired at the end of the afternoon shift, providing approximately 2,000 tons per shot. Fragmentation of the ore has been good in nearly every case, and Broken Hill has experienced no trouble in maintaining a vertical pillar line.

Ore was drawn along the haulageway only as it was required to provide space for subsequent breaking. Full-scale haulage did not take place until the entire stope was fired.

Overhead loaders work the draw points, discharging into standard 66-cubic-ft Granby-type cars. Each draw point is equipped with a special water spray to keep down dust in the loading operation. (*E&MJ*, June 1956)

Normally, Broken Hill has employed cut and fill methods throughout its operation because the walls are generally weak. However, both shrinkage and long-hole drilling have now been tried, with, the company says, great increases in economy in the cases where the methods were called for.

In October 1957, *E&MJ* described long-hole raising at Zinc Corp. which involved drilling down from a drift into an orebody. The description of that method appeared on p 114 of the 1957 issue, noting that the firm got not only cheaper production but improved safety. In the present long-hole stoping, safety is also increased, since there is no entry into the working stope by men at all.

PRIMARY CRUSHER is located at the entrance of the pit, serving the secondary crusher plant above, through an incline conveyor belt and 6,000-ton underground bin.

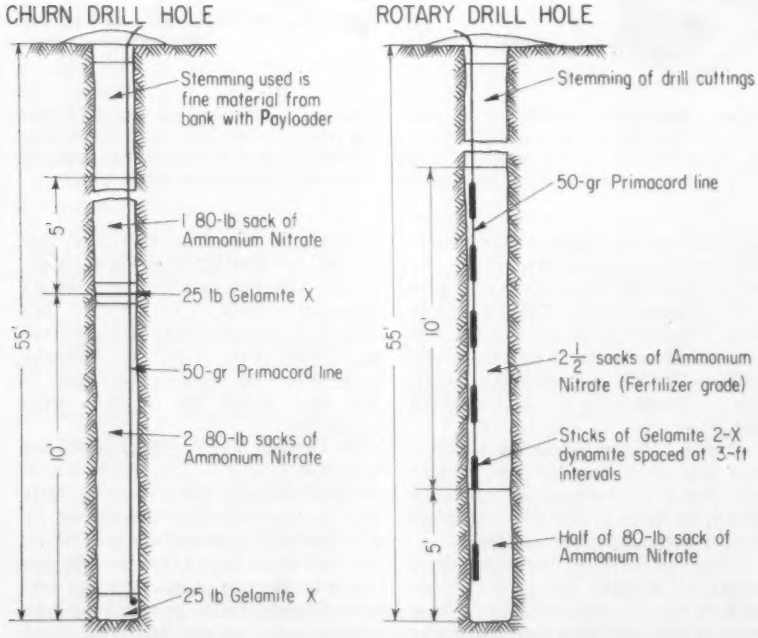
MAINTENANCE program provides for lubrication, engine and tire checks.

Bagdad Reports Haulage Costs

JOHN B. HUTTL

EVERYONE INTERESTED in open pit mining who goes through Arizona makes it a point to stop off to see the property of Bagdad Copper Corp., about 115 miles northwest of Phoenix.

Part of this desire to visit Bagdad arises from natural interest in any large pit operation, but part is certainly due to curiosity aroused by the mining methods and equipment employed there to meet conditions imposed by adverse terrain and isolated locale of the mine.



TWO TYPES of blastholes are employed—7-in. Gelamite-fired churn drill holes and 6¾-in. (or 6½) rotaries using sticks of Gelamite 2-X as a booster shot.

The Bagdad orebody lies in a deep ravine, presenting serious problems in the initial establishment of the pit in 1944 and requiring periodic changes in methods and equipment to keep operations at desired efficiency. Pit planning and design or layout must be closely controlled to avoid overly high stripping ratios and road grades.

The mine for many years has been a testing ground for primary haulage units, with the manufacturers of trucks working closely with the company in the matter of investigating untried design features and new parts of trucks. This work led to the adoption and improvement of auxiliary parts such as torque converters, transmissions, and others, and opened new avenues of approach for better truck designs in general. The records covering the different primary haulage units in operation in the pit are perhaps the most complete found in the industry.

Developing the Pit

The ore is a chalcocite-enriched zone in gray monzonite porphyry. It dips at from 5 to 10 deg to the northeast, with thickness averaging 120 ft. Overburden consists of Gila conglomerate up to 400 ft thick, resting on a layer of decomposed porphyry containing low values in oxidized copper. This material is stockpiled for future leaching. The overburden is fairly soft, and the ore moderately hard.

Annual Truck Record Shows Hours, Tons, Miles and Costs

Units and make		Performance: Hours, miles and tons — In ore	In waste	Total	Percent Operated	Operating Cost ($): Fuel	Lubrication	Tires and tubes	Repair labor	Parts	Operating labor	Total
13 22T Dart Cummins	Hours	14,603.0	20,881	35,484.0	68.7							
	Miles	62,300.8	161,395	233,695.8								
	Tons	1,103,526.0	2,031,745	3,135,271.0								
	Miles/gal					0.9259						
	Cost/mile					0.1897	0.0239	0.3519	0.0451	0.1396	0.3561	1.1063
	Cost/ton					0.0135	0.0017	0.0251	0.0032	0.0099	0.0254	0.0788
3 22T Dart W/TG	Hours	2,336.0	1,697.0	4,033.0	23.7							
	Miles	8,999.3	12,296.5	21,295.8								
	Tons	186,344.0	146,501.0	332,845.0								
	Miles/gal					0.6574						
	Cost/mile					0.2669	0.0317	0.3916	0.0850	0.4171	0.3763	1.5686
	Cost/ton					0.0171	0.0020	0.0254	0.0054	0.0267	0.0241	0.1007
8 30T Dart 30 SL	Hours	1,772.0	29,386.0	31,158.0	69.8							
	Miles	8,447.2	236,632.0	245,079.2								
	Tons	174,212.0	3,697,230.0	3,871,442.0								
	Miles/gal					0.8918						
	Cost/mile					0.1960	0.0193	0.3229	0.0453	0.2204	0.3195	1.1240
	Cost/ton					0.0124	0.0012	0.0204	0.0029	0.0140	0.0202	0.0711
6 55T Dart 55-T-1	Hours	4.0	17,550.0	17,554.0	62.3							
	Miles	29.4	128,589.8	128,619.2								
	Tons	790	2,528,020.0	2,528,810.0								
	Miles/gal					0.7119						
	Cost/mile					0.2469	0.0264	0.5308	0.0419	0.2094	0.3657	1.4211
	Cost/ton					0.0126	0.0013	0.0270	0.0021	0.0107	0.0186	0.0723
2 55T Dart Butane	Hours		5,768.0	5,768.0	61.5							
	Miles		40,879.9	40,879.9								
	Tons		828,720.0	828,720.0								
	Miles/gal					0.3843						
	Cost/mile					0.2717	0.0192	0.2539	0.0401	0.1657	0.3876	1.1382
	Cost/ton					0.0134	0.0009	0.0125	0.0020	0.0082	0.0191	0.0561
5 22T Euclid	Hours	157.0	47.0	204.0	5.0							
	Miles	362.5	307.8	670.3								
	Tons	13,586.0	5,140.0	18,726.0								
	Miles/gal					0.6439						
	Cost/mile					0.2625	0.0274	0.1522	0.0528	0.0407	0.5370	1.0726
	Cost/ton					0.0094	0.0009	0.0054	0.0019	0.0015	0.0192	0.0383
1 50T Euclid	Hours		3,073.0	3,073.0	65.2							
	Miles		23,489.5	23,489.5								
	Tons		587,570.0	587,570.0								
	Miles/gal					0.7475						
	Cost/mile					0.2345	0.0454	1.3819	0.0430	0.0720	0.3527	2.1295
	Cost/ton					0.0094	0.0018	0.0552	0.0017	0.0029	0.0141	0.0851
1 E-40 Tournarocker	Hours	2.0	265.0	267.0	7.2							
	Miles	4.5	1,858.8	1,863.3								
	Tons	262.0	28,890.0	29,152.0								
	Miles/gal					0.6416						
	Cost/mile					0.1590	0.0118	0.1316	0.1338	0.0616	0.5509	1.0487
	Cost/ton					0.0102	0.0008	0.0084	0.0086	0.0039	0.0352	0.0671
1 E-50 Tournarocker	Hours	13.0	364.0	377.0	10.5							
	Miles	46.1	2,306.4	2,352.5								
	Tons	2,745.0	49,462.0	52,207.0								
	Miles/gal					0.7603						
	Cost/mile					0.1341	0.8158	1.5278	0.0518	0.0329	0.4569	2.2193
	Cost/ton					0.0060	0.0007	0.0688	0.0023	0.0015	0.0206	0.0999
40 Totals	Hours	18,867.0	77,031.0	97,918.0	58.7							
	Miles	80,189.8	607,755.7	687,945.5								
	Tons	1,481,465.0	9,903,278.0	11,384,743.0								
	Miles/gal					**0.7868**						
	Cost/mile					**0.2115**	**0.0232**	**0.4090**	**0.0457**	**0.1886**	**0.3483**	**1.2263**
	Cost/ton					**0.0128**	**0.0014**	**0.0247**	**0.0028**	**0.0114**	**0.0210**	**0.0741**

The pit is roughly oval in shape, currently measuring some 2500 ft across the longer axis and 2000 ft across the shorter axis. Entry is by combination spiral and switchback system. Haulage roads for waste in general are laid out on a 7% grade, and those serving ore haulage on a 12% grade maximum.

Distance of round trip waste haul is about 3.2 miles, and that of the ore haul 1½ miles. Width of roads is 45 ft, and great care and attention is given them in the matter of maintenance. At the time of *E&MJ's*

Typical Monthly Truck Performance

Performance

Bagdad shop vehicle number	Hours operated				Miles travelled		Tons hauled	
	Available	In ore	In waste	Percent operated	In ore	In waste	In ore	In waste
D-12	304	80	93	56.9	293.2	679.0	6,048	7,613
D-14	344	172	58	66.9	751.7	405.0	13,592	4,761
D-15	352	129	58	51.1	593.2	390.2	9,960	4,738
D-16	360	121	153	76.1	524.4	1,018.8	9,431	12,409
D-17	360	130	142	75.6	436.6	602.2	10,439	15,824
D-18	344	125	90	62.5	470.8	643.8	9,759	7,130
D-19	368	256	42	80.9	951.6	282.6	20,018	3,335
D-20	360	161	47	57.8	601.6	301.8	12,613	3,772
D-21	344	63	95	45.9	226.8	625.8	5,488	3,797
D-22	360	156	70	62.8	658.4	466.8	12,354	8,188
D-25	336	41	108	44.3	138.8	790.9	3,373	10,580
D-27	368	55	207	71.2	66.0	1,417.5	6,915	21,930
D-28	336	39	158	58.6	1,127.7	1,317.7	4,341	16,830
total	4,528	1,528	1,321	62.8	6,940.8	8,942.1	124,331	124,907
D-23	336	21	42	18.8	60.4	280.5	1,816	3,496
D-24	336	—	3	0.9	—	18.0	—	230
D-26	336	3	—	0.9	4.4	—	219	—
total	1,008	24	45	6.8	64.8	298.5	2,035	3,726
D-29	336	16	166	54.2	1,124.6	1,204.2	1,407	16,710
D-30	344	26	233	75.3	112.8	1,574.9	2,335	26,230
D-31	336	5	131	40.5	29.2	899.8	269	13,500
D-32	336	2	182	54.8	7.2	1,262.8	179	18,060
D-33	336	1	176	52.7	0.4	1,267.6	29	18,180
D-34	344	40	97	39.8	125.2	673.2	4,371	9,960
D-35	336	7	293	89.3	32.0	2,108.3	718	31,200
D-36	344	19	179	57.6	66.4	12,211.1	1,946	18,810
total	2,712	116	1,457	58.0	1,497.8	10,201.9	11,254	153,250
D-37	336	—	246	73.2	—	1,787.0	—	31,710
D-38	336	—	306	91.1	—	2,229.0	—	39,440
D-39	336	—	138	41.1	—	973.6	—	17,600
D-40	336	—	196	58.3	—	1,409.6	—	24,840
D-41	336	—	229	68.2	—	1,649.4	—	28,920
D-42	336	—	269	80.1	—	1,983.4	—	34,960
total	2,016	—	1,384	68.7	—	10,032.0	—	177,470
D-43	336	—	198	58.9	—	1,393.8	—	24,600
D-44	336	—	9	2.7	—	72.0	—	1,200
total	672	—	207	30.8	—	1,465.8	—	25,800
LLD total	336	—	236	70.2	—	1,774.0	—	39,350
Total all trucks	**11,280**	**1,668**	**4,650**	**56.0**	**8,503.4**	**32,714.3**	**137,620**	**524,503**

visit in 1958, the pit was producing 6,776 tpd ore and 30,000 tpd waste.

The nearby concentrator was handling 4850 tpd. Current waste-ore ratio averages 5:1. Normally, the ratio figure is 2½:1. Copper content in the ore today is about 1%, and that of molybdenite 0.03%.

In the pit, both ore and waste benches are carried at 50 ft. Primary blastholes on the benches are drilled with churn drills (B-E 27-T and B-E 22-T) and rotary drills (Winter-Weiss Portadrill and Joy 225). The churn drill units use 7-in. bits and the rotaries 6¾- and 6¼-in. Tricone-type bits.

All blastholes are drilled 5 ft below grade, or to a total depth of 55 ft. Spacing on single row is 15x15 ft in waste and 12x12 ft in ore. The distance from the rim of the bench in ore and waste is 9 ft and 9 to 15 ft, respectively.

Feet per shift drilled by the churn drills averages 73.6 ft in waste and 55.8 ft in ore. For the rotaries these figures are 285 and 166.5 ft. Life of the Tricone bits in waste is about 900 ft and in ore 300 ft. Bits are retired and retipped on contract. It has been found that the bits will stand two retippings, each giving about 200 ft of drilling, increasing the aforementioned bit life to 1300 ft and 700 ft. Slightly worn bits purchased from oil companies tested recently drilled 200 ft before retipping was required. These units stood two retippings, each giving 200 ft of drilling, indicating a total bit life of about 600 ft.

Churn drill and rotary drill blast-

And Cost Summary At Bagdad

Cost

Supplies					Labor and Parts			
					Labor			
Fuel (gal)	Oil (quart)	Zero-lene	Red engine oil	No. 140 gear lubricant	Hours	Cost ($)	Parts cost ($)	Bagdad shop vehicle number
1,383	72	5	—	12	87.50	174.70	452.54	D-12
1,753	152	5	—	6	38.50	77.54	155.84	D-14
1,340	168	5	—	27	20.75	40.33	41.43	D-15
1,943	116	10	—	40	41.00	83.20	140.41	D-16
1,988	127	10	—	19	4.75	9.50	2.64	D-17
1,660	98	—	—	49	3.00	6.10	2.68	D-18
1,017	125	—	—	7	20.75	43.76	5.86	D-19
1,471	171	5	—	73	20.50	40.73	4.32	D-20
1,295	136	—	—	28	31.00	63.44	87.77	D-21
1,515	6	—	—	70	21.25	43.19	86.58	D-22
1,134	86	—	—	4	16.50	33 15	23.24	D-25
1,848	86	—	—	5	34.00	68.04	54.45	D-27
1,595	196	—	—	85	36.50	74.02	339.60	D-28
19,942	1,539	40	—	425	376.00	$757.60	$1,397.36	total
($3,529.73)	($286.64)	($4.69)	—	($65.03)	—	—	—	
607	16	—	—	—	9.00	17.91	6.55	D-23
127	8	—	5	35	8.00	16.72	52.94	D-24
129	—	—	—	6	11.00	23.32	15.86	D-26
863	24	—	5	41	28.00	$57.95	$75.35	total
($152.75)	($4.47)	—	($2.17)	($6.27)	—	—	—	
2,088	114	—	—	6	61.25	121.40	836.48	D-29
2,071	98	10	—	17	21.00	67.09	9.13	D-30
1,517	165	—	—	3	47.00	99.04	154.61	D-31
1,640	153	5	—	30	49.25	96.94	123.33	D-32
1,429	122	5	—	38	23.00	44.60	25.48	D-33
1,109	59	—	—	11	87.50	182.43	2,045.12	D-34
2,464	127	—	—	9	16.50	34.56	11.96	D-35
1,726	74	—	—	8	65.50	133.52	528.90	D-36
14,044	912	20	—	122	371.00	$779.58	$3,735.01	total
($2,485.79)	($169.86)	($2.35)	—	($18.67)	—	—	—	
2,753	146	—	—	54	44.00	117.14	570.83	D-37
3,013	130	—	—	29	10.25	20.42	3.22	D-38
1,418	46	—	—	39	103.75	223.12	931.00	D-39
1,892	95	—	—	118	13.50	55.84	203.53	D-40
2,160	260	5	—	30	59.50	121.80	650.94	D-41
2,458	207	5	—	72	15.00	31.26	8.74	D-42
13,694	884	10	—	342	246.00	$569.58	$2,368.26	total
($2,423.84)	($169.65)	($1.17)	—	($52.33)	—	—	—	
3,221	189	5	—	14	47.00	97.26	450.29	D-43
187	—	—	—	—	1.00	1.00	2.00	D-44
3,408	189	5	—	14	48.00	$98.26	$452.29	total
($603.22)	($35.39)	($0.59)	—	($2.14)	—	—	—	
2,100	361	—	—	24	15.50	$32.18	$10.94	total LLD
54,051	**3,909**	**75**	**5**	**968**	**1,084.50**	**$2,296.15**	**$8,037.21**	**All trucks total**
($9,567.03)	**($728.25)**	**($8.80)**	**($2.17)**	**($148.11)**	—	—	—	

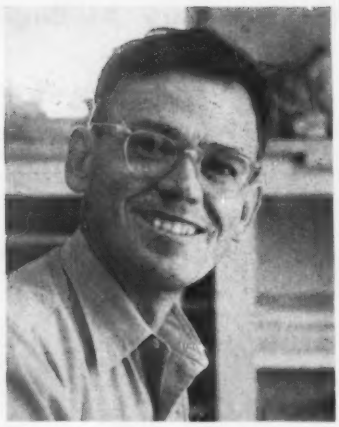
holes are blasted with fertilizer-grade ammonium nitrate. Three 80-lb sacks of this powder, each sack receiving 1 gal diesel oil prior to being dumped into the hole, are being used in each hole.

Distribution of the powder load and position of primers in the churn drill and rotary drill holes are shown in the accompanying sketches. Drill cuttings are used for stemming in the rotary drill holes and fine material brought from the banks by Payloaders in the churn drill holes. Powder factor in waste is 7½ tons per lb and in ore 5 tons per lb. The company is also experimenting with 400-grain Primacord, 1-ft lengths spaced at 3-ft intervals on regular 50-grain Primacord line, to detonate the blasthole charge.

At the benches, broken ore and waste are loaded into truck by electric and diesel-powered shovels for transportation to the primary crusher station near the main pit entrance and to waste or leach dumps. Primary crushing is done in a 40x42-in. A-C jaw crusher. The crushed product is transported by a 36-in. inclined belt conveyor to a 6000-ton underground storage bin, whence it is withdrawn by a pan feeder and subsequently directed to the secondary crushing plant at the concentrator via a 36-in. covered inclined belt conveyor. In the event of belt conveyor failure, ore is hauled by trucks direct to the steel storage bin at the old shaft.

The primary haulage equipment consists of the following truck units:

GENERAL MANAGER at Bagdad mill and pit is George W. Colville.



MINE SUPERINTENDENT and chief engineer is E. L. Jones.

INSPECTING a shovel boom in the yard is Charles R. Hammon, right foreground.

Sixteen 22T end-dump Darts; eight 30SL end-dump Darts; six 55-T-1 end-dump Darts; two 55T end-dump Darts (butane); and one 50T end-dump Euclid. The five 22T end-dump Euclids and E40 Tournarocker and E50 Tournarocker operated during 1957 currently are not in use.

Additional Equipment

Service units include two sprinkler trucks, 4500- and 2500-gal capacity; three Adams road graders; service truck for churn drills; grease truck; three Tournadozers; two Caterpillar D-8 tractors; three International TD-24 dozers; Austin-Western boom crane; and A-C forklift. Operational data covering the primary haulage units are given in the accompanying tables.

Shovel equipment available at the pit comprises one 9-yd P&H 1800 electric unit; one 6-yd P&H 1600 electric unit; one 4½-yd P&H 1400 electric unit; two 3-yd P&H 1055 units, one electric and one diesel powered; and a 2½-yd Northwest diesel-powered shovel.

The company maintains modern and well-equipped repair, maintenance and inspection facilities for the truck fleet near the main entrance of the pit. Here, major and minor repairs can be carried out on loading, haulage and auxiliary equipment. All buildings housing the different sub-assembly shops are of fire-proof, steel-frame construction. The main shop building houses five service bays and a grease pit.

A 5-ton Monorail crane is available to facilitiate lifting heavy parts. The sub-assembly units include a blacksmith shop, tire shop, welding shop, and an engine repair shop with a Monorail crane. Truck washing facilities consist of a large concrete apron served by a Malsbary steam cleaning machine. All shops are equipped with modern tools and metal working machines, and an adequate stock of spare parts is carried in the warehouse at all times.

Equipment maintenance follows more or less standard practice, Fuelling of trucks is done between shifts, usually requiring about one hour. Each truck is greased every third day, and while on the grease pit it is given a thorough inspection. Oil in engines is changed at 100-hr intervals. Engines are given a general overhaul between 4000 and 5000 hours of operation.

Recently, the Twin-Disc torque converters on the trucks were changed from the original CF to CO units. Another change made was to put new torque arms on the front axle running from the axle to the front end frame, and changing the rear torque arms to run forward on the frame instead of extending to the rear of the frame. Engine, converter and transmission mountings were replaced with midship mountings.

All tire and maintenance work is done by a contractor, who is also carrying out recap work in Phoenix. The company recently tested bomber tires released for sale by the Government, but found them unsatisfactory. The tire is not designed for use on trucks.

E&MJ wishes to thank J. C. Lincoln, president, Bagdad Copper Corp. for permission to publish the aforegoing article. The help and cooperation given by G. W. Colville, general manager, and E. L. Jones, mine superintendent and chief engineer, are acknowledged and appreciated. Other staff members are R. C. Bogart, general superintendent; G. C. Campbell, geologist; G. W. Guest, mill superintendent; D. T. Holmes, metallurgist and chief assayer; Chas. R. Hammon, master mechanic; and T. A. Smith, mill master mechanic.

Texaco Patents Instant Oxide Leach Process

A PATENT HAS BEEN granted to Peter L. Paull, Norwalk, Conn. and assigned to Texaco Development Corp., N. Y., N.Y. that uses heat, pressure, ammonia and carbon dioxide in such a manner as to instantaneously pulverize and leach oxide minerals from low grade ores. Patent No. 2,847,300 specifically mentions such oxidized minerals as malachite, smithsonite, calamine and hydrozincite.

Basically the process is one of heating the ore slurry to high temperature under high pressure, then releasing the pressure to disintegrate the ore particles while at the same time adding ammonia and carbon dioxide to react with the minerals.

One example from the patent will suffice: a low grade zinc ore containing 4.21% smithsonite was crushed to 14 mesh, slurried with water and pumped at 505 psi through 400 ft of ½-in. iron pipe at 935 lb/hour feed rate to an opposed nozzle grinder having 5/32-in. orifice. Outlet pipe temperature was 900 deg F, and downstream pressure was 32 psi. Particles disintegrated to minus 325 mesh. Ammonia and carbon dioxide were injected at the pressure release point and all the zinc minerals went into solution. Solution was filtered, and the zinc precipitated as hydrous zinc carbonate assaying 57% zinc and giving a 93% recovery of the contained zinc.

USKORONA SPLICING TAPE

THE SPLICE OF LIFE

When you splice and reinsulate with Uskorona® and re-jacket with "D.R." splicing compound, you renew the life of the cable. *The entire splice will last as long as the cable.*

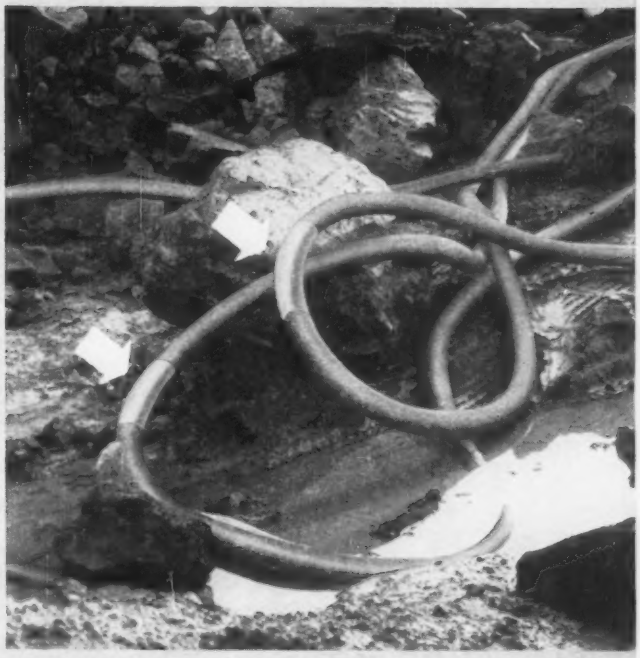
These entirely reliable tapes are:

- Extra-tight gripping, plus high in tensile strength.
- Resistant to acid, alkalies and moisture ... ideal for use on mining machine cables.
- Impossible to pinhole, so dangerous leaks can't occur.
- Absolutely waterproof.

Uskorona exceeds A.S.T.M. specifications and can handle a wide range of electrical and general purpose jobs in mines. A complete line of mine tapes is available.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.



ABOVE GROUND. When spliced with Uskorona and "D.R." tapes, cables become perfect again. These splices restore the mechanical and dielectric quality of the cable, resist severe abrasion and exposure to moisture.

BELOW GROUND. Being run over by cable cars in coal mine can't hurt Uskorona splices protected by "D.R." splicing compound. They take this punishment many times a day.

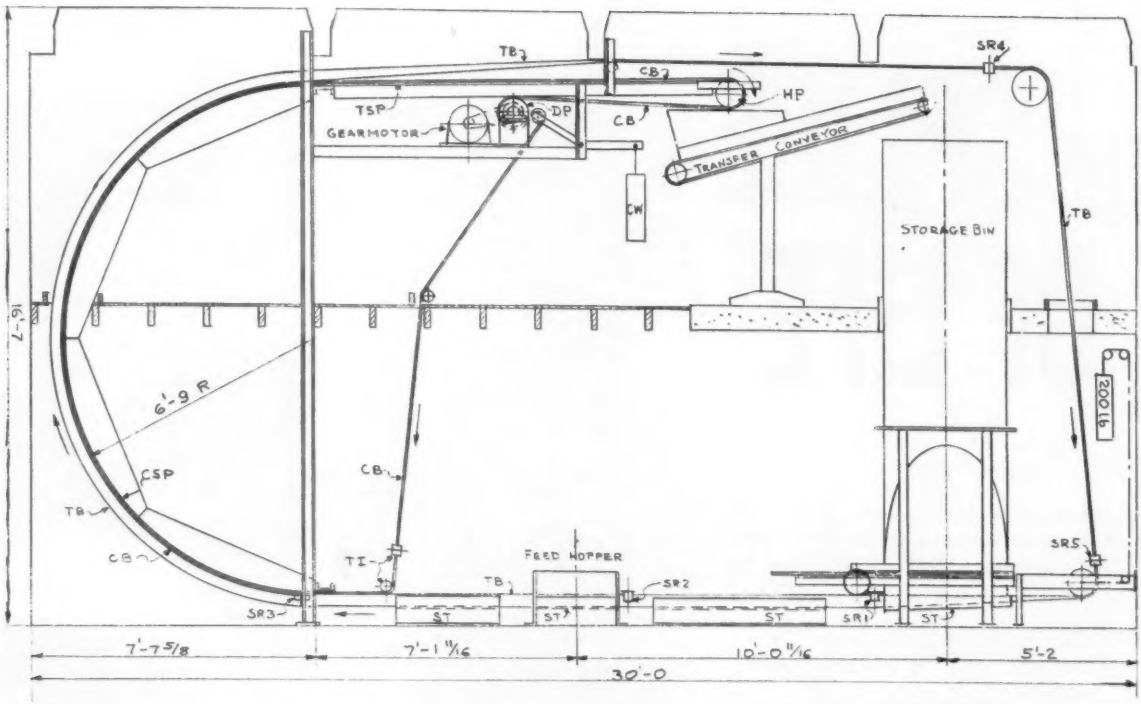
Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

OPERATING IDEAS



Troughed Belt Conveyor-Elevator Simplifies Vertical Transport

IN TRYING TO FIND a conveyor-elevator to handle 300 cu ft per hr of material weighing up to 150 lb per cu ft, technicians at the Bulk Solids Flow Laboratory, University of Utah, were up against a problem. The material was to be picked up on the lower floor at either one of two feed points or both feed points simultaneously, to be elevated to the upper floor, a height of 13.5 ft, and to be discharged at one point. The nature of the work would require numerous recirculations of the materials, and, therefore, the conveyor-elevator had to handle gently, without shearing the material, and preferably without rehandling. Furthermore, the conveyor should be, as far as possible, self-cleaning to allow the change of tested materials without contamination.

After eliminating the possibilities of using any one of a number of existing conveyor setups, the experimenters resorted to one of their own making, the troughed belt conveyor-elevator.

In a University bulletin describing the operation, A. W. Jenike, P. J. Elsey and R. H. Wooley said that "the conveyor is made up of two belts; the troughing belt (TB) and the closing belt (CB). The troughing belt follows an approximately rectangular path; it runs troughed along that part of the path which carries material and flat along the remainder of the path. The closing belt covers the troughed belt along the curved path, where material is elevated, and carries material along the top run discharging over the head pulley (HP). The curved path is formed of a steel slide plate (CSP) supported by a steel and wooden frame.

"Only the closing belt is driven. The troughing belt is propelled by the closing belt through friction along the lines of contact on the curved path. Both belts are tensioned by gravity take-ups. The troughed belt is guided along its path by five pairs of side rollers (SR). Roller SR1 forces the belt to form a trough, SR2 controls the width of the trough as the belt enters the feed hopper, SR3 guides the belt at the entry onto the curved slide plate, and SR4 and SR5 guide the belt at corner pulleys. The closing belt is controlled by a training idler (TI) as it enters the curved slide plate. The troughed belt is supported by steel troughs (ST) along the bottom run. The closing belt is also supported by a steel troughed slide plate (TSP) along its horizontal upper run.

"The conveyor travels at 70 ft per minute and is driven by a 1½-hp gearmotor. The pulley diameters are small in order to save space, particularly headroom. For instance, the head and drive pulleys of the closing belt are 8 in. in diameter, the take-up and training idlers are 3½ in. in diameter. The corner pulleys of the troughing belt are 12 in. and 8 in. in diameter.

"The closing belt is 12 in. wide and is made of 3 ply, 32 oz cotton-nylon fabric with 1/32-in. rubber cover on the load carrying side and friction surface facing the slide plates. The troughing belt is 10 in. wide and contains two 3/16-in. diameter steel cables at the edges. A nylon breaker fabric is used in order to make the belt freely extensible between the cables, and to force the cables to take up most of the belt tension. This is necessary to assure the retention of the trough and the provision of a seal between the two belts along the elevating part of the conveyor".

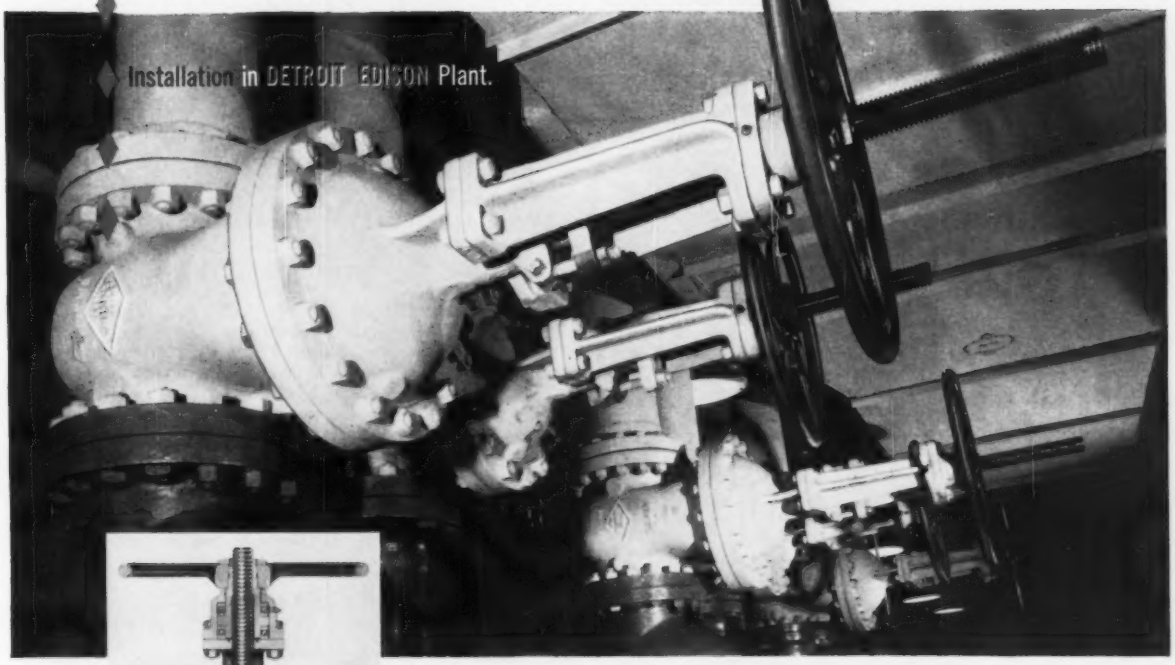
An alternative conveyor system could be used. Here the troughing belt would be back-tracked, while the closing belt extends over standard troughing idlers to discharge over the head pulley into a receiving hopper. To save space, slide plate could have a varying curvature.

"The drive in the present arrangement is applied to the closing belt, but it is entirely feasible to drive the troughing belt instead of the closing belt or to drive both belts. This offers further flexibility of layout and capability to extend the length and the lift of the conveyor. The present belts are 12 in. and 10 in. wide, but they could be made wider and the belt velocity of 70 ft per minute could be increased to enhance the capacity of the conveyor.

"While speculating, one could mention the possibility of a slide plate which is not only curved but also twisted, thus allowing a three dimensional layout of the conveyor."

where they really know Costs

—you'll likely see the famous Jenkins mark on CAST STEEL Valves



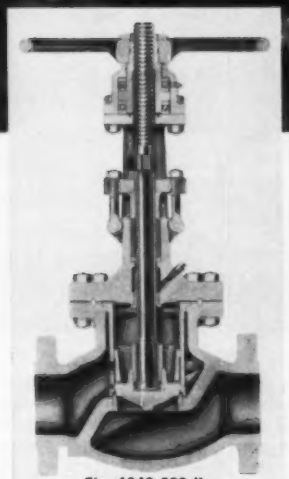


Fig. 1046 600 lb.
O.S. & Y. Globe

Typical Jenkins features deliver lasting economy

A ball bearing yoke sleeve is standard on larger sizes • Cooling chamber and plugged connection for test purposes is regularly provided below packing box, but a lantern gland stuffing box is optional • Rustproof, lubricated and graphited, wire reinforced packing is standard • Soft steel ring joint body-bonnet gasket, fitted into accurately matched grooves to assure a vapor-tight joint • Seating is regrind-renew type.

In the power generation and industrial processing plants where Cast Steel valves are numbered by the score . . . where replacement and maintenance costs are recorded to the last penny . . . the true economy of Jenkins Valves is clearly seen.

Records will always show the extra value which Jenkins builds into Cast Steel valves, not only with design features you can see but also with unbending quality standards for alloys, castings, machining. Plus the toughest known testing and inspection system to assure perfection in every detail, and safety factors far beyond ratings.

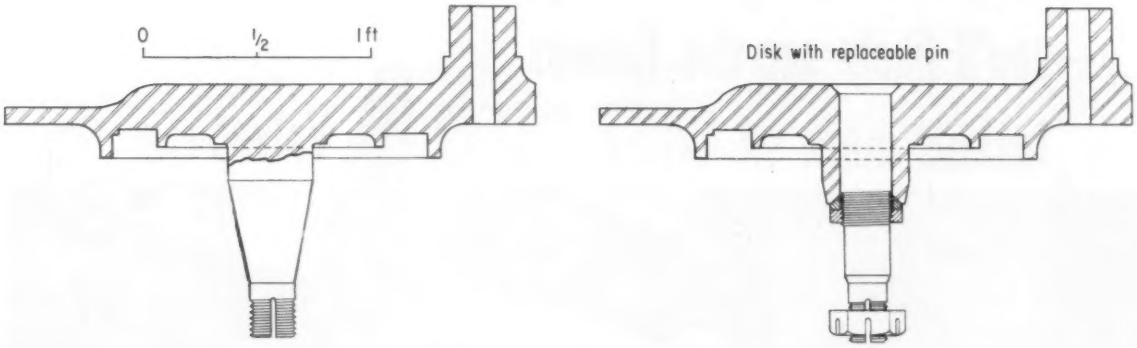
Select from the Big Line in this Catalog. It includes pressure castings of Carbon, Carbon-Moly, 1¼% Chromium-Moly, 4% — 6% Chromium-Moly, 3½% Nickel . . . alloys that meet a wide variety of specifications. Also, a wide choice of patterns, sizes and seating material combinations to satisfy your different service conditions.

CALL YOUR JENKINS DISTRIBUTOR for a copy of Jenkins Cast Steel Valve Catalog and prices. Or write to Jenkins Bros., 100 Park Ave., New York 17.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864
Jenkins Bros.

Sold Through Leading Distributors Everywhere

OPERATING IDEAS *(Continued)*



Easy-To-Replace Crank Disk Pin Eases Loading Machine Downtime

MAINTENANCE COSTS of loading machines at the potash mines of International Minerals & Chemical Corp., Carlsbad, N. M., have been greatly reduced by altering the design of the crank disk pin. The crank disk produces the eccentric action of the claw-like gathering arms on the front end of the loaders and the pin had formerly been cast as an integral part of the disk. In the event of pin failure, the entire assembly had to be replaced by a new unit which normally involved an expense of approximately $340.00.

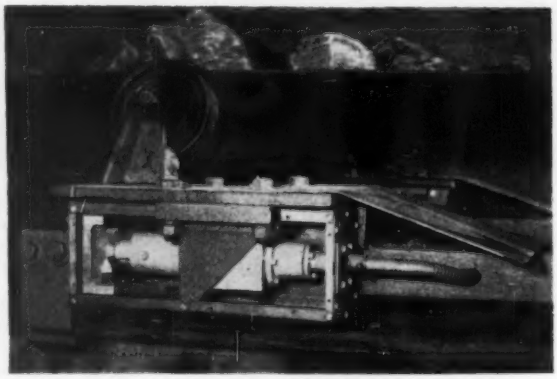
The new disk design called for a replaceable pin. In order to bring this about, the company had to (1) bore out the center of the disk to accommodate the separate pin, and (2) make the pin and appurtenant lock units from special steel. The original disk modification can be done for about half the cost of a new unit. After that, all that is needed in the event of failure is replacement of the worn or broken center pin, reducing costs and increasing loader availability.

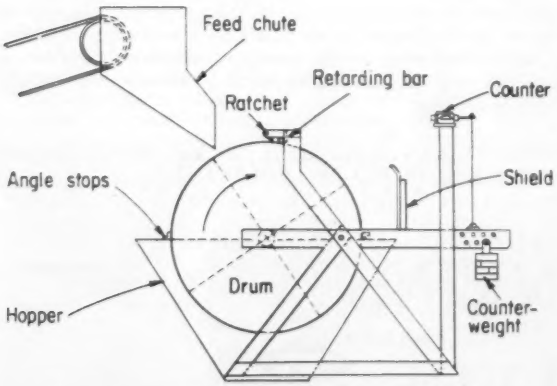
Strain Gage Tallies Belt Load

AN AUTOMATIC, compact electronic conveyor load totaling device has been developed by S. A. Philips (Pty.) Ltd., Johannesburg, South Africa.

The system's load cell consists of a steel column which is located in the center of a protective housing. Varying conveyed loads compress the column to correspondingly minute degrees (usual range is from $\frac{1}{100}$ to $\frac{1}{1000}$-in.). Strain gages are firmly cemented to the column and undergo similar compressions.

These gages characteristically change their electric resistance in proportion to the amount of compression. The recorded resistance change then becomes a direct measure of the load applied and consequently of the object which is placed on the load cells. Reliable and accurate functioning of the load cell depends on the properties of the steel column, the strain gage and the bonding layer.





Sectioned Drum Counts Ore

AN EASY-TO-BUILD weighing arrangement (accurate to within about 2%) has given satisfactory service at a western lead-zinc mine in checking tonnages of ore conveyed from the crushing plant to the fine-ore bins at the head of the grinding department.

Weigher assembly parts, all of mild steel construction, consist of a revolving drum containing four storage compartments and having small angle stops on the periphery about midway between the partitions; lever in which the drum operates; and frame-type mounting. The drum, supported on the pivoted and counterbalanced lever, is pushed up against a retarding bar until a certain predetermined weight of ore has been reached in one of the compartments. Drum's forward rotation and kickback are respectively prevented by the angle stop bearing against the retarding bar and the ratchet contacting the angle stop at the rear. The counterweight may be attached to the lever arm at any one of several points so that the weight required to release the drum may be varied as desired.

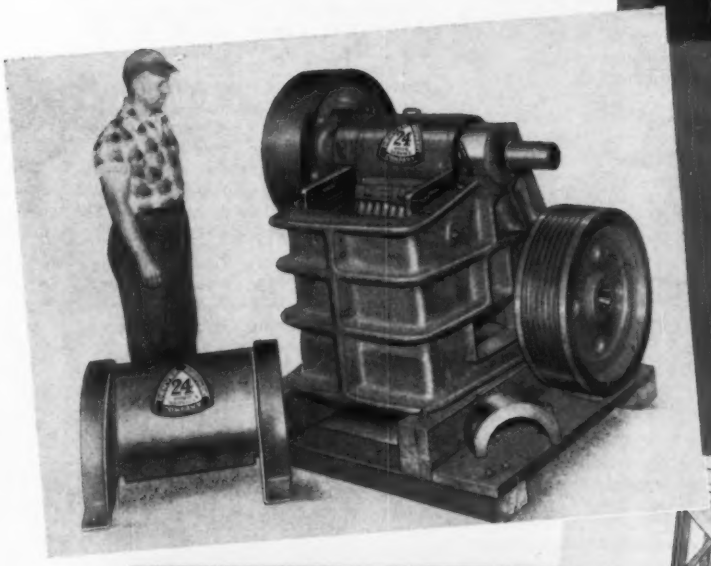
Operation is simple. Material flows from the feed chute into the drum compartment in loading position until the counterweight is balanced. Having done so, the drum quickly rotates clockwise, discharging its contents into the hopper. Rotation continues until the angle stop of the following compartment strikes the retarding bar, holding the compartment in loading position. The cycle continues as long as the material flows, each dumping being recorded on a counter so that at stated intervals the weight that has passed may be calculated by multiplying the weight per dump by the number of dumps.

For Maximum Tonnage at Lowest Cost

DENVER

- LOW INITIAL COST
- LOW MAINTENANCE
- LONG SERVICE

CRUSHERS



- Massive, heavily reinforced, cast steel frame and bumper.
- 13 – 14% Manganese steel jaw and cheek plates. Jaw plates reversible for longer wear.
- Oversize eccentric shaft built of special alloy steel.
- Protective shield over bearing housing.
- Anti-friction roller bearings throughout. Side bearings sealed in carrier, permits removal of bumper without exposing bearings to dust and dirt.
- Safety toggle protects crusher from tramp iron. **Shipment from stock** in sizes 5"x6", 8"x10", 10"x16" and 10"x20". Larger sizes to 36"x48" available.

SCREENS

- Hi-capacity, patented, 2-bearing design.
- Flywheel weights counterbalance eccentric shaft, giving a "true circle" motion to screen.
- Spring suspensions carry the weight. Bearings support only weight of shaft. Screen is free to "float" and follow positive screening motion without power-consuming friction losses. Saves up to 50% HP over 4-bearing types.

Sizes from 1' x 3' to 5' x 14', single or double deck types, floor mounted or with suspension frames.

DENVER Crushers and Screens IN STOCK *for Quick Delivery*

"The firm that makes its friends happier, healthier and wealthier"

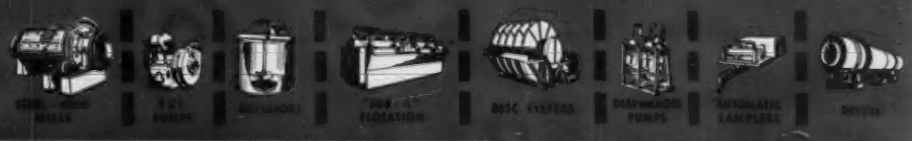
DECO ENGINEERS — DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

Complete Mill Equipment

DENVER EQUIPMENT COMPANY

1400 Seventeenth St. - Denver 17, Colorado

- DENVER
- NEW YORK
- TORONTO
- VANCOUVER
- MEXICO, D.F.
- LONDON
- JOHANNESBURG
- LIMA



WHAT'S NEW IN U. S. PATENTS

OLIVER S. NORTH

Mining

In a method for preventing subsidence of overlying formations or caving of adjacent rock bodies into mined out areas, the roof is shot down when withdrawing from a section; for example, by using roof bolt holes as shot holes. Fragmented material fills the workings and supports adjoining ground. P. B. Bucky. No. 2,846,205.

A composition is described for coating surfaces of storage, handling and transporting equipment which come into contact with ores or moist minerals, whereby such materials are prevented from sticking to those surfaces when freezing temperatures prevail. Composition consists of "dicyclo-topping," "header acids," isopropyl alcohol, naphtha, and fuel oil. J. P. Pardo, assigned to Sta-Vis Oil Co. No. 2,846,336.

Improved grinder for dressing tungsten carbide bits. The grinding wheel is simultaneously reciprocated, oscillated and moved transversely of the path of reciprocation whereby the desired shape is ground on the tip of the drill bit. H. E. Ingersoll. No. 2,847,800.

Design for an improved mine shaft mucking machine. The apparatus is suspended from a frame over the shaft, and can be lifted to permit blasting. Controls are located so that the operator may control the bucket from a position directly above the bucket or from the level of the muck pile. J. A. Drain, J. E. Gordon and J. A. Read, assigned to Joy Manufacturing Co. No. 2,849,138-9.

Metal and Mineral Processing

Process for separating cobalt and nickel values in acidic solutions. Solution is conditioned with lime or the like to a pH of 7.5 to produce insoluble metal hydroxides, and then treated with oxygen-enriched gas. Recovered solids are leached with an aqueous ammoniacal ammonium sulphate to solubilize nickel values. F. A. Schaufelberger, assigned to Chemical Construction Corp. No. 2,845,333.

Blast furnace bath temperature is adjusted simply and effectively by pressure feeding through a pipe oxygen or CO_2 gases or the like into the molten pig iron. K. Kanamori, one-half assigned to Yawata Seitetsu K. K. No. 2,845,343.

Process for smelting iron ore fines directly to the metal state with gaseous, liquid or powdered fuels. Caking and sintering difficulties are overcome, and the gangue and coal ash are separated in a liquid slag. W. Wenzel. No. 2,846,300.

Direct smelting of flotation or magnetic concentrates of iron or copper ores. W. E. Greenawalt. No. 2,846,301.

Direct smelting of iron ore concentrates, whereby milling costs are lessened, sintering is avoided, and hot blast stoves are not required. W. E. Greenawalt. No. 2,846,302.

Production of stable crystals of titanium of sufficiently large size so that aqueous leaching may be employed to separate the product titanium from by-product salt. W. H. Keller and I. S. Zonis, assigned to National Research Corp. No. 2,846,303-4.

Method of drying Florida pebble phosphate ore to make the ore particles more susceptible to charging by contact, and subsequently more responsive to electrostatic forces. J. E. Lawver, assigned to International Minerals & Chemcial Corp. No. 2,847,123.

Continuous process for treating arsenopyrite ores under fluidizing conditions. De-arsenication is effected prior to the roasting step. A. V. Ortuno, C. I. Fernandez and C. M. Serrano, assigned to Instituto Nacional de Industria. No. 2,847,281.

COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D. C.

Method and apparatus for economically purifying and de-sulphurizing high-lead sphalerite concentrates to produce a high grade zinc calcine suitable for producing high-quality zinc and a lead-enriched calcine suitable for making prime western zinc. C. C. Long and H. K. Najarian, St. Joseph Lead Co. No. 2,847,294.

Process for extracting metal values economically from low grade ores, such as smithsonite, hydrozincite, calamine, and ores of copper, lead, nickel, cobalt, etc. Ore is wet ground in the presence of ammonia and CO_2 to form water-soluble metal complexes, which are subsequently separated by filtration, decantation, or other suitable procedure. P. L. Paull, assigned to Texaco Development Corp. No. 2,847,300.

Design for a mechanism for controlling passage of iron ore pellets or the like through a shaft furnace. Pellets are effectively heated and continuously discharged at the bottom of the furnace with a minimum of pellet breakage. I. H. Wynne, H. K. Martin and K. M. Haley, Oglebay etc. No. 2,848,208.

Conversion of rutile ore to lower oxides of titanium. Mixture of ground ore and carbon is heated in a hydrogen atmosphere. H. S. Cooper and M. W. Weil. No. 2,848,303.

Removal of copper from siderite or similar iron ores by thermal splitting and magnetizing roasting. Chlorine gas is introduced into the fluidized bed of roasted ore. A. Johannsen, G. Wittman, A. Dietrich and W. Gebhard, assigned to Badische Anilin- & Soda-Fabrik Aktiengesellschaft. No. 2,848,314.

Improved process for directly reducing iron ore in a fluidized bed. A portion of the feed is maintained larger than 10-mesh for the purpose of preventing dust loss at higher-than-usual gas velocities. W. L. Davis Jr., J. Feinman and L. R. Little Jr., assigned to U. S. Steel Corp. No. 2,848,316.

Process for producing high-grade manganese from siliceous ores thereof in a shaft furnace of comparatively low height, commonly called a low-stack blast furnace. Ore-carbon mixture is reduced by a blast of oxygen-enriched air. P. Tardieu, assigned to Pechiney, Compagnie de Produits Chimiques et Electrometallurgiques. No. 2,848,318.

Method for producing high-purity nickel and cobalt from mixed solutions thereof. A divalent ammonia nickel complex and a higher valent ammonia cobalt complex are adsorbed onto a cation exchange resin. Nickel complex is then eluted from the more strongly adsorbed cobalt complex. J. B. Conn and W. K. Humphrey, assigned to Merck & Co., Inc. No. 2,848,322.

Improved process for recovery of gallium compounds from coal combustion gases. M. Inagaki and Z. H. S. S. Kenkyujo. No. 2,848,398.

Means and method for densifying the anode sludge in zinc electrowinning processes. No. 2,848,399.

These Patents—17 Years Old—Have Now Expired

Condensing magnesium from vapor phase admixture with carbon monoxide. R. C. Kirk, assigned to Dow Chemical Co. No. 2,257,910.

Extracting vanadium from ores. J. Robertson, H. E. Dunn and A. A. Sproul, assigned to Vanadium Corp. of America. No. 2,257,978.

Producing pure antimony oxide from sulphide or oxide ores. A. R. Bozarth, assigned to Harshaw Chemical Co. No. 2,258,441.

Recovering columbium from ores and concentrates by acid decomposition. H. Schlecht and L. Schlecht, assigned to Walter H. Duisberg. No. 2,259,396.

Producing beryllium chloride from mixtures obtained in working beryl ore. H. von Zeppelin, assigned to Walter H. Duisberg. No. 2,259,403.

Tall oil flotation of manganese oxide. R. C. Hill, assigned to Freeport Sulphur Co. No. 2,259,420.

Extracting finely disseminated gold from sedimentary rock. C. H. Humphries. No. 2,260,670.

Mr. North is patent consultant, Washington, D.C.

B.F.Goodrich

B.F.Goodrich tires haul coal uncovered by world's largest shovel

BIG PAUL takes a 70-yd., 105-ton bite of overburden at the Peabody Coal Company's River King mine near Freeburg, Ill. This world's largest shovel towers 147 ft. 6 in., can dig, hoist, swing and dump its load in 50 seconds! The coal it uncovers is hauled by truck to the preparation plant 5 miles away. The road has a rock base—and loads run as high as 80 tons. Peabody assigns this rugged hauling job to B.F.Goodrich Rock Service tires. Here's why:

Rock Service tires are built with B.F.Goodrich FLEX-RITE NYLON cords that withstand double the impact of ordinary cord materials, resist heat blowouts and flex breaks. No wonder the FLEX-RITE NYLON body outwears even the extra-thick Rock Service tread, can be retreaded over and over!

Husky Rock Service cleats grip the ground for positive traction in forward or reverse. The tire is built to flex evenly—no localized strains that cause unnecessary tire failures! See the new B.F.Goodrich Rock Service—tube-type or Tubeless—at your B.F.Goodrich dealer's. He's listed under Tires in the Yellow Pages of your phone book. Ask to see his complete line of tires for every mining job. *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

Smileage!

B.F.Goodrich *truck tires*

© The B.F.Goodrich Company

PERSONALS

Archibald

Ralph S. Archibald, chairman and former president of North Range Mining Co., Negaunee, Mich., will deliver the Jackling Lecture at AIME's annual meeting in San Francisco in February 1959. (See also last month's issue of *E&MJ*, p 131.)

Robert D. Longyear of Minneapolis, president of E. J. Longyear Co. and Canadian Longyear Ltd., has retired from that post to assume the newly created position of chairman of the board. **Donald M. Davidson,** vice president, has succeeded him as president of the mining division.

Arthur C. Bigley, general manager of Western mining operations of Anaconda Co., retired as of Sept. 1. Bigley, who started as a miner in Butte in 1913, was graduated from Colorado School of Mines, receiving in 1950 the school's individual merit award for achievement in mining industry. He is a member of AIME, American Mining Congress and Northwest Mining Association.

Dr. Armine F. Banfield, after serving for eight years as an associate of Behre Dolbear & Co., was admitted to partnership in the firm on July 1.

Thomas Vivian Baines has been appointed consulting geologist to the International Nickel Co. in Africa. A geology and chemistry graduate of University of South Africa, Baines has been with Inco since 1951 and has been in mining geology and exploration work in various parts of Africa. He is a member of the Geological Society of South Africa.

Dr. Charles H. Prien, director of Chemistry and Chemical Engineering Division, Denver Research Institute, University of Denver, delivered an address recently at the Denver Mining Club, on the coming importance to Colorado of the oil shale industry in the Rifle area.

Glen A. Sarberg, Virginia, Minn., of Oliver Iron Mining division, has been appointed supervisor of cost planning and analysis for the Canisteo district with offices at Coleraine. **Charles A. Lindberg,** assistant superintendent of maintenance, has retired.

George Marcinel, research enginer, is now at Atikokan, Ont. with the Charleson Iron Mining Co. of Hibbing, Minn.

James M. Doyle, safety engineer for M. A. Hanna Co., has been transferred from the Mesabi range to Michigan. He will supervise safety at Cannon, Groveland and Moose Mountain mines when operations are resumed.

Charles C. Goddard Jr. replaces **Edward P. Shea** as geologist of the Anaconda Co.'s Butte mines. Shea, promoted to company geologist for Montana, was succeeded by **Wallace A. O'Brien** as mines geologist.

Ira K. Hearn Jr. is now the assistant general manager of the Utah Copper division of Kennecott Copper Corp.

Fred Jensen has been appointed deputy state mine inspector for northern Arizona mining districts.

Peter S. Jack, metallurgical engineer at Potash Co. of America refinery, has been promoted to general refinery foreman, a newly created position. A graduate of University of British Columbia, Vancouver, Jack was formerly with Brittania Mining & Smelting, Ltd.

Evan Just, formerly vice president of Cyprus Mines Corp., is now president of International Drilling & Water Co., Inc., 630 Fifth Ave., New York City. He is also available as a geological and exploration consultant. Mr. Just, at one time editor of *Engineering and Mining Journal,* was educated at Northwestern University, where he received a bachelor of science degree in geology, and at University of Wisconsin, a master's degree. While with Aluminum Co. of America, he served as geologist and drilling supervisor examining bauxite deposits in Russia, and was division engineer for Carter Oil Co. Metals, nonmetallics and petroleum have occupied his attention also in the U.S. and Brazil. He has also served as instructor in geology at Lehigh University, as assistant professor of geology and petroleum technology at the New Mexico School of Mines, and has taught mineral economics in the graduate school at Columbia University. From 1936 to 1942 he was secretary of the Tri-State Zinc & Lead Ore Producers Association. From July 1948 to November 1949 he took over the duties of director of the Strategic Materials Division of the Economic Cooperation Administration.

Just

J. William Stoner has retired as secretary and treasurer of United Park City Mines Co., Salt Lake City, Utah, after a half century's association with western mining. He is succeeded by **E. LaMar Osika.**

Alan E. Gallie of Sherritt Gordon Mines staff was transferred to Toronto to the post of assistant to the president; **J. Ross Muter** is now manager of the mining and milling division at Lynn Lake, Man.; **Peter Cain** is general superintendent; **Ewart Mitchell** is acting mine superintendent.

James E. Harkness, Cleveland, of Pickands, Mather & Co. corporation department, has retired. He began in 1916 as an assistant secretary to the late Samuel Mather. **S. O. Park,** of the geological department, after 15 years of service in Hibbing, Crystal Falls, Mich., and in Duluth offices, has also retired.

Hugo E. Johnson, of Shaker Heights, O., was elected president of American Iron Ore Association, Cleveland, as of Sept. 1. Formerly vice president and secretary, Mr. Johnson succeeds **Franklin Pardee,** who has retired.

Stanford V. Smith Jr., mining engineer of Hibbing, Minn., has been appointed superintendent of the Susquehanna Ore Co., succeeding M. G. Woodle, who is now at Reserve Mining Co.

Byron E. Grant, formerly with U. S. Smelting and Refining Co. and with Braden Copper Co. since 1955, has been promoted to the post of general manager. He will retain his residence and office in Coya, Chile.

Robert C. Baxter, former superintendent of pit No. 1 of Erie Mining Co., has been transferred to Pickands, Mather & Co.'s Cleveland office in the mining department.

Eugene Lindsey, formerly with Anaconda Co., is now associated with Wisser & Co., consulting geologists, San Francisco.

Russell H. Crouse, mining engineer graduate of University of Utah, has been named production superintendent of Monsanto Chemical Co.'s Soda Springs, Idaho elemental phosphorus complex. He succeeds **Wallace T. Dunlap Jr.,** an M.I.T. graduate, who was named production superintendent at the company's Martinsville, W. Va. plant of Mobay Chemical Co.

John H. East Jr., of Denver, regional director of the Bureau of Mines' 8-State Region III, has been voted Department of the Interior's Distinguished Service Award and gold medal, in recognition of more than 20 yr of achievement with the Bureau in mining engineering, health and safety work, executive administration, and as an author of several publications, chiefly in the field of mine safety.

Dr. William P. Yant, of Pittsburgh, was presented on Sept. 17 with the Arthur Williams Medal, at the annual award dinner of the American Museum of Safety, in the Roosevelt Hotel, New York. The 18th recipient of the award, Dr. Yant, who is a director of research and development for Mine Safety Appliances Co., has contributed to industrial and public safety 38 U. S. patented inventions and 28 foreign patents.

James C. Smith succeeds the late **D. J. Cross** as mining recorder for Thunder Bay district of Ontario.

(Continued on p. 130)

CONTRACTORS: SPECIFY YOUR POWER →

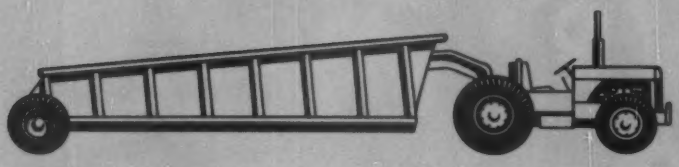
STANDARDIZE ON CUMMINS

MORE THAN 300 MODELS of construction equipment are available with Cummins power!

FUEL COST SAVINGS alone will be as much as 50¢ per operating hour!

CUMMINS POSITIVE DIRT PROOFING SYSTEM adds years to the life of the engine!

CUMMINS FIELD SERVICE availability insures 'round the clock operation!

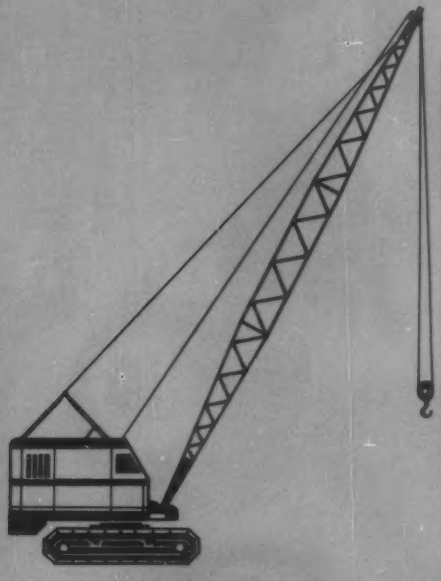


BOTTOM DUMP

Size	Autocar	Euclid	Kenworth	KW-Dart	Le Tourneau Westinghouse
16 Yds. (Struck)					C
17 Yds. (Struck)		28TDT-122W			
25 Yds. (Struck)		33LTD-132W			
35 Yds. (Struck)	AP-25T			70 BDW	
COAL HAULERS					
25 Tons		76FDT-121W			
40 Tons		33LDT-133W			
50 Tons	AP-25T			50S-BDT	
51 Tons		24TDT-128W		70S-BDT	
70 Tons			803-T		

TRACTOR-SCRAPERS

Size (cu. yds. heaped)	Clark	Euclid	I.H.	Le Tourneau Westinghouse	M-R-S	Wagner	Wooldridge	Westfalt
5.7						IND-6		
9						IND-9		
10.5	110							
12						IND-14		100
13			2T55					
16		76DT-18SH						
18				C				175
19	210							
21			2T75				CW-215	
25		28TDT-36SH			125	IND-24		
26								Performer
27				B	150		CW-320	
29	310							
32		33LDT-32SH			190			
41.5					200			
48					250			

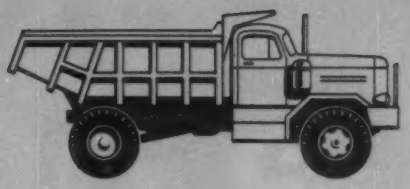


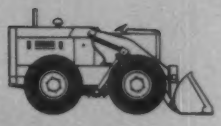
CRANES

Size (tons)	American Hoist	Baldwin Lima	Bay City	Dominion	Gar Wood	Insley	Le Tourneau Westinghouse	Link-Belt Speeder	Marion	Orton Crane	Thew
6										3E-UDT	
7.5										6E-UDT	
10										8E-UDT	
15										12E-UDT	
20		34, 25-T			75BT		C			16E-UDT	
21									35-M		
25		34-T, 34-TS, 44	600		100BT			HC-88	35-MTC	22E-UDT	
27									43-M		
30		44-T	720				B	HC-98	37-MTC		SP-530
32										26E-UDT	
35		54-T 604 703		480		WB		HC-108			MC-530 (Both MC-503 Carriers TSP-650W and Turntables)
40	595C	64							43-MTC	32E-UDT	
43									362		
45						WB					
50		64-T, 64-SC, 703-SC, 803								42E-UDT	
60				550							
70		1201, 84-T									
75									87-M		
80									93-M		
84									101-M		
85		1250									
100		1250-SC									
168									111-M		

REAR DUMP TRUCKS

Size (tons)	Autocar	Euclid	I.H.	Kenworth	KW-Dart	Le Tourneau Westinghouse	Mack	Oshkosh	Wooldridge
10					10S				
15	AP-15	80FD			15SL		LRX		
18		94FD	PH65	801					
22		36TD 46TD				C		W-2500	
22½							LVX		
24			PH95	802					
25	AP-25				25S 25SL				CWD-214
27		66TD							
28								W-2800	
30					30SL		LRSW		
34							LRVSW		
35					35T 35SL	B			CWD-321
36				803					
40	AP-40	10FFD							
48				802-B					
50		4LLD			50T				
64				803-B					





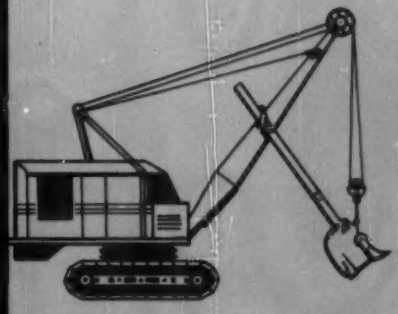
TRACTORS

Size (H.P.)	Eimco	Le Tourneau Westinghouse	R-B-S	Wagner	Westfall
110				IND-6	
130				IND-9	100
160	105-T			IND-14	
175					175
210		C			
220			125	IND-18	Performer
262			150		Performer
300				IND-24	
310			190		
335			200		Performer
600			250		

TRACTOR SHOVELS

Size (yds.)	Clark	Eimco	Frank G. Hough (IH)	Mixermobile	Pettibone-Mulliken	Thew
1½		105 (Excavator)		LD5PD	125	
1¾						ML-153
1½				LD7D		
2¼			HOD		175	
2½				LD7AD		
2¾	175A	105				
3½				LD8AD	250	
4	275A					
4¾				LD12AD		
6	375A			LD18AD LD12AD		

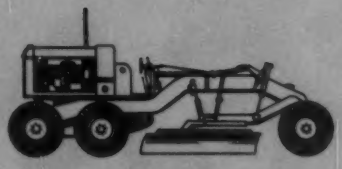
SHOVELS



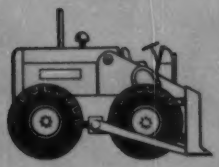
Size (yds.)	American Hoist	Baldwin Lima	Bay City	Bucyrus Erie	Dominion Engn. Wks.	Insley	Koehring	Link-Belt Speeder	Mazi-trenia	Marion Power	Orton	Thew
½											3E-CDT	
¾	300	34						LS-88		35-M	6E-CDT	
1	500	44	60			WB		LS-98	1600	43-M	8E-CDT	
1¼		64							2000		12E-CDT	Lorain 56
1½	700	604	72	30-B	480			K-360		362	16E-CDT	
1¾		703						K-365 K-370 K-375			22E-CDT	
2		802		51-B			805		3000		26E-CDT	
2½		803			550					93-M	32E-CDT 42E-CDT	
2¾				54-B					3500			
3				71-B			1205	K-608 K-608-L	3600	101-M		
3½		1201										
4		1601		88-B					4500	111-M		
5									4500			
5½									4500			

GRADERS

SIZE (H.P.)	ADAMS	GALION	HUBER-WARCO
80	330		
100		104	
115	440		
123	550		
130		T-500 116	6-D2
135	550-T		
160	660	T-600 160	7-D2
190	660-T	T-700	



TRACTOR-DOZERS



Weight (lbs.)	Clark	Eimco	Le Tourneau Westinghouse	Wagner	Westfall
16,500					100
20,100				IND-14	
22,500					175
27,600				IND-18	
33,380	180				
34,600			C		
37,000		105 105-T			
40,000					Performer
51,300	280				
74,150	380				
104,000	480				

SPECIALIZED CONSTRUCTION AND MINING EQUIPMENT MANUFACTURERS WITH CUMMINS (STANDARD OR OPTIONAL) POWERED MODELS

AIR COMPRESSORS
Chicago Pneumatic Tool Co.
Joy Manufacturing Company
Worthington Corporation

BATCH PLANTS
Barber-Greene Company
Hetherington and Berner Inc.
Iowa Manufacturing Co.

BUCKET LOADERS
Barber-Greene Company
Pettibone-New York Div.

COMPACTORS
Buffalo—Springfield Roller Company

CRANE CARRIERS
Baldwin-Lima-Hamilton
Crane Carrier Canada Ltd.
Crane Carrier Corporation
Hendrickson Manufacturing Company
KW-Dart Truck Company
Sicard, Inc.
The Maxi Corporation

CRUSHING PLANTS
Bros Inc.
Diamond Iron Works
Eagle Crusher Company
Iowa Manufacturing Company
Lima Austin-Western
Universal Engineering Company

DITCHERS
Barber-Greene Company

DRILLS
Reich Brothers Manufacturing Co.

MIXERS
Barber-Greene Company
Bros Inc.
Iowa Manufacturing Co.
Pettibone-Wood Manufacturing Co.

PAVERS
Chain Belt Company (Rex)
Iowa Manufacturing Co.
Worthington Corporation

ON AND OFF-HIGHWAY DUMP TRUCKS IN 82 MODELS BY 18 MANUFACTURERS

REPOWER WITH CUMMINS

32 models for every application

HP	Model
100 h.p.	J-6
110 h.p.	JF-6
115 h.p.	HR-4
115 h.p.	HRC-4
130 h.p.	NHC-4
130 h.p.	JN-6
130 h.p.	NT-130
160 h.p.	JS-6
160 h.p.	H-6
165 h.p.	NT-4
175 h.p.	JNS-6
175 h.p.	HR-6
175 h.p.	JT-6
180 h.p.	NT-180
180 h.p.	NH-180
190 h.p.	HRF-6

HP	Model
195 h.p.	NH-195
200 h.p.	HS-6
200 h.p.	NT-200
220 h.p.	NH-220
240 h.p.	HRS-6
250 h.p.	NT-6
262 h.p.	NTO-6
265 h.p.	L-6
290 h.p.	NHS-6
300 h.p.	NRT-6
320 h.p.	NHRS-6
320 h.p.	LR-6
335 h.p.	NRTO-6
450 h.p.	NVH-12
450 h.p.	LRT-6
600 h.p.	VT-12

Only Cummins offers a diesel for every construction machine . . . with these features!

- **Cummins Engineered Repowering.** Job-site or shop conversions. Installations are made from factory approved repowering studies.
- **Cummins Long Engine Life.** Better heat dissipation afforded by 4-cycle design, coupled with Cummins sturdier construction of crankshaft and other components, means longer engine life for you.
- **Cummins Economy.** The highly efficient Cummins designed combustion chamber provides maximum fuel economy—saving as much as 50¢ per operating hour!
- **Cummins PT Fuel System.** With only 188 parts, as much as 275 fewer parts than competitive systems, you have simplicity and economy of maintenance.
- **Cummins Dirt-Proofing.** Air cleaners, caps, connections, oil system and all entrance points for destructive grit have been made dirt-proof by Cummins proven protective system.
- **Cummins Service.** Geared to your on-the-job service needs —just call your local Cummins Distributor and he'll be there —more than 300 service points throughout the U.S. and Canada.

CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA

EXPORT — CUMMINS DIESEL EXPORT CORPORATION — COLUMBUS, INDIANA, U. S. A. — CABLE: CUMDIEX
OVERSEAS FACTORY — CUMMINS ENGINE COMPANY LIMITED — SHOTTS, LANARKSHIRE, SCOTLAND — CABLE: CUMSCOT SHOTTS TELEX

Litho in U.S.A.

Bethlehem Hollow Drill Steel tackles sandstone at site of Dyberry Dam, a flood control project in eastern Pennsylvania. Contractor: The Hunkin-Conkey Construction Co., Cleveland. Drill steel reconditioner: Howells Mining Drill Corp., Plymouth, Pa.

They moved 270,000 cu yd for new flood control dam

Using Bethlehem Hollow Drill Steel to drill the blast holes, they recently moved some 270,000 cu yd of sandstone in the initial phase of building Dyberry Dam near Honesdale, Pa. To control the Dyberry Creek, the earth-and-rock dam, 1600 ft long and 112 ft high, is being built under the direction of the U. S. Army Corps of Engineers, Philadelphia district.

The blast holes which were put down by the contractor, The Hunkin-Conkey Construction Co., averaged 10 ft in depth. The Bethlehem Hollow was used in wagon drills, jackhammers, and drifters.

Bethlehem Hollow Drill Steel is ideal for all types of rock drilling because it is rolled from fatigue-resistant steel, and has a uniform, centrally located hole. Besides having a wide quenching range, Bethlehem Hollow is easy to heat-treat for the proper balance of toughness and wear resistance, thus making possible tough threads and shanks.

Bethlehem Hollow comes in Carbon and Ultra-Alloy grades in rounds, hexagons, and quarter octagons, in lengths from 18 ft to 27 ft. Longer lengths can also be furnished. No matter how tough the drilling, you can count on Bethlehem Hollow to give you top performance.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL
CARBON *AND* ULTRA-ALLOY

BETHLEHEM STEEL

PERSONALS *(Continued)*

John D. MacKenzie, president of American Smelting & Refining Co., has been elected chairman to fill the vacancy caused by the death of Kenneth C. Brownell. Mr. MacKenzie will continue as president of Asarco. He was educated as a mining engineer and metallurgist and joined Asarco in 1920 as a chemist at the Garfield, Utah, smelter. In 1948 he became vice president in charge of smelting operations and in 1949 was elected a director. He became president last April. He is also a director of Revere Copper & Brass Inc., General Cable Co., Southern Peru Copper Corp. and Western Phosphates Inc., and is a member of Revere and General Cable's executive committees.

MacKenzie

A. W. McNeil and **R. C. Ashenhurst** have been appointed general manager and secretary-treasurer, respectively, of Staneligh Uranium Mining Corp. Ltd. McNeil, a mining engineer graduate of Queen's' University, has spent the past six years as manager of Chibuluma Mines Ltd., prior to which he had been with other mining companies in the Northern Rhodesia copper belt for 20 years, and three years in Canada with International Nickel Co., and Hollinger Consolidated Gold Mines Ltd.

Willis M. Johns has joined the staff of Montana Bureau of Mines and Geology as geologist-in-charge of the field station in Kalispell. He holds degrees in geological engineering from Montana School of Mines and was formerly with American Smelting & Refining Co. in Salt Lake City, working on exploration projects, and as resident geologist at Asarco's open-pit mine near Tucson, Ariz.

Robert B. Hoy, formerly chief geologist of northeastern U. S. for New Jersey Zinc Co., is now assistant to the chairman of the earth sciences department of Stanford Research Institute, Menlo Park, Calif.

I. G. Irving is now in mining geologic consulting work with Investment Exchange, 706 Securities Bldg., Seattle, after shutdown of the Norwich manganese mine at Butte, Mont., which he co-managed with his former partner, **R. H. Nelson.**

Jack H. McWilliams, geological engineer for Aluminum Co. of America since 1942, has been made manager of ore exploration for the company's mining division. He succeeds **Dr. A. H. Sutton,** who will reside in Columbus, Ind. and perform special assignments in Alcoa's geological programs. A graduate of Colorado School of Mines, McWilliams joined Alcoa in 1942.

Russell L. Richards, formerly with Newmont Mining Corp., has been appointed president of Western Gold & Uranium Inc. **Richard V. Wyman,** formerly general superintendent, was made vice president. **Maurice Castagne** was appointed superintendent of the Orphan mine, Grand Canyon, Ariz.

John B. White Jr. has resigned as chief engineer for Western Knapp Engineering Co. to accept a position as manager of engineering, Fremont Minerals Inc. and Mines Development Co., Denver, wholly owned Susquehanna Corp. subsidiaries.

Dr. John S. Rinehart, assistant director of Smithsonian Astrophysical Observatory and astronomy-research associate at Harvard University becomes a full professor of mining engineering at the Colorado School of Mines this fall.

Dr. Schrade F. Radtke is the newly named director for joint research program initiated by world-wide lead and zinc producers and under the direction of the Industry Development Committees of the American Zinc Institute Inc. and the Lead Industries Association. As research director he will develop plans governing research projects of the respective associations and will recommend the degree of emphasis to be placed on fundamental and applied research.

Radtke

At Kennecott Copper Corp.'s Ray Mines division, nine promotions and reassignments were made recently: **Thomas L. Hillman,** former assistant chief power plant engineer, is now chief engineer in charge of the Hayden plant and smelter; **Frank Woodruf,** former divisions project engineer, has been made reduction superintendent; **George Sewell** is the new mill scheduling foreman; **A. T. Shykas,** industrial engineer, is new superintendent of the concentration mill at Hayden; **George Allen,** former shift foreman in the sponge iron and acid plant, became test engineer in the engineering department; **John M. Hood** is now division industrial engineer; **John Patton,** former surface foreman at Ray, is now general foreman of the sponge iron and acid plant at Hayden; **John Cooper,** former Hayden mill expansion project engineer, is plant engineer, now; and **Raymond V. Testa,** comptroller for Tin & Associated Minerals, Ltd., Nigeria, West Africa, has been named assistant division comptroller for the Ray Division.

H. MacKay was elected a director of Coniagas Mines, replacing R. O. Pennington, who had resigned.

O. H. Chavez, formerly sales manager of Cia Mexicana de Explosivos S.A., Du Pont subsidiary, has been promoted to manager of relations of both DuPont S.A. and Cia Mexicana de Explosivos S.A. Mr. Chavez was graduated from the Texas College of Mines and Metallurgy in 1940, and worked with mining companies in the U. S. and Mexico. **Mario L. Pena,** superintendent of production at the Dinamita, Durango explosives plant, has been made sales manager of Cia. Mexicana de Explosivos. Both are members of AIME, Mexico City section.

Dr. John Chipman, professor of metallurgy, Massachusetts Institute of Technology, will become president of the Metallurgical Society of AIME for one year beginning next February at the annual AIME business meeting, succeeding **Dr. Walter R. Hibbard Jr. Dr. Carleton C. Long** was elected vice president. He will succeed Dr. Chipman as president in 1960. Dr. Long is director of research, Zinc Smelting division, St. Joseph Lead Co., Monaca, Pa. New Directors of the Metallurgical Society taking office in February, will be: **Ralph W. Farley,** Republic Steel Corp., Chicago, 3 yr; **Dr. John H. Hollomon,** manager, metallurgy and ceramic research, General Electric Co., Schenectady, N. Y., 3 yr; **Albert E. Lee Jr.,** American Metal Climax Inc., 1 yr; **Oscar T. Marzke,** vice president-research, U.S. Steel Corp., Pittsburgh, 1 yr; **John D. Sullivan,** technical director, Battelle Memorial Institute, Columbus, Ohio, 3 yr; **Michael Tenenbaum,** superintendent, metallurgy department, Inland Steel Co., East Chicago, Ind., 1 yr.

John D. Simpson and **John W. Austin,** president and vice president, respectively, of Placer Development Ltd., Vancouver, B. C., were elected directors of International Mining Corp. (known prior to June 5, 1958 as National Department Stores Corp.), principal shareowner of Placer. **Lewis B. Harder,** president of South American Gold & Platinum Co. and a director of Placer Development, was elected chairman of the board of IMC.

Edward H. McCleary, of Philadelphia, has received the U. S. Department of the Interior's' meritorious service award and silver medal in recognition of more than 15 years of superior service in Bureau of Mines health and safety work.

B. W. Reeve succeeds the late F. A. Flodin as president of Lake Shore, Inc. Lake Shore's board has also elected **Mrs. F. A. Flodin** to a directorship and **Frederic Sammond,** Milwaukee, to the executive committee. **R. S. Shepard,** manager of the company's Minnesota operations, was elected vice president.

P. K. Haney was elected a director of Consolidated Red Poplar Minerals Ltd. and **J. C. L. Allen** was named president, at a board meeting held recently.

PRODUCER

The Wemco Mobil-Mill:

Standard of Heavy Media Separation Plants; Operators' Choice — World Wide

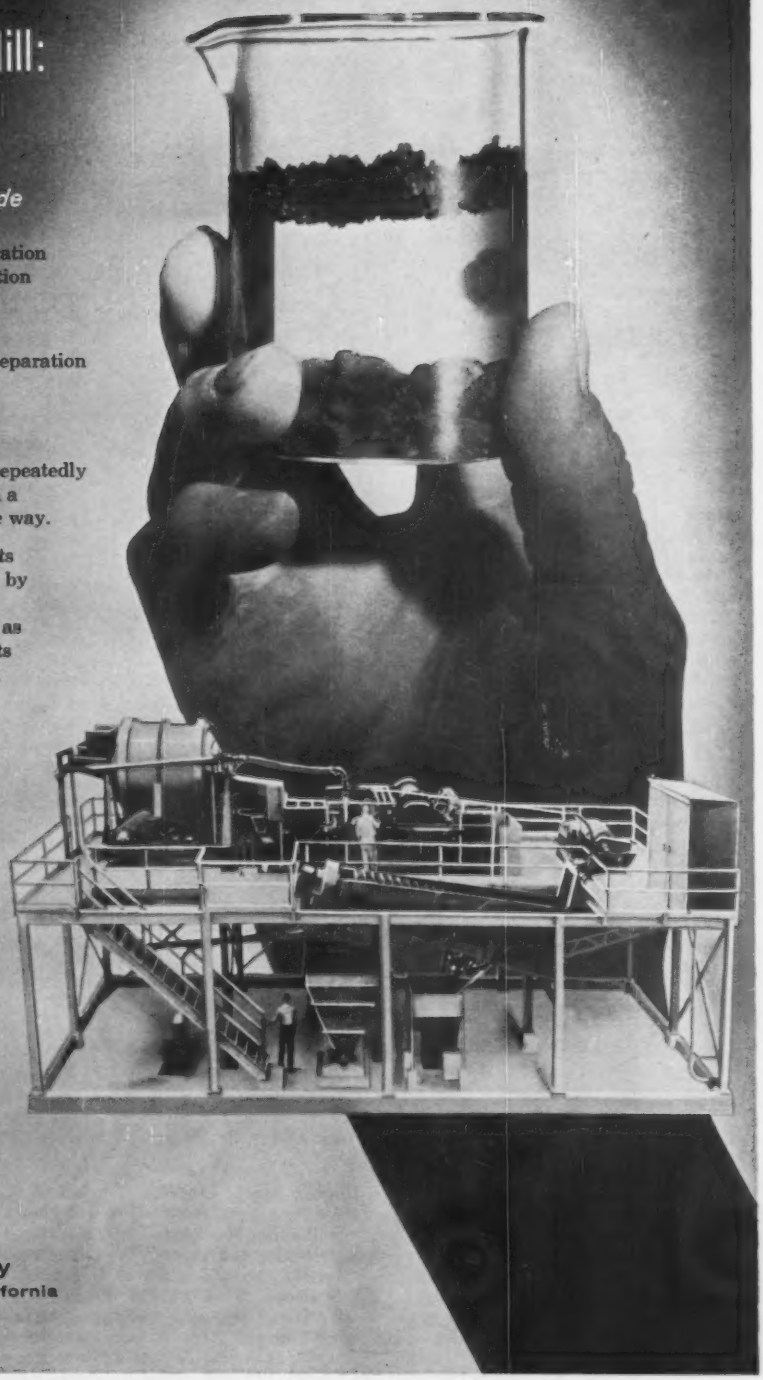
The choice of the Heavy Media Separation process for profitable premium production is a sound one.

And the use of the one-man-operated Wemco Mobil-Mill for Heavy Media Separation is more and more a standard for optimum results.

The reason: complete, pre-engineered, pre-fabricated and integrated design, repeatedly proved to answer recovery problems in a low-cost, low-maintenance, *dependable* way.

The Wemco Mobil-Mill is known for its ease and rapidity of erection — even by inexperienced personnel; proved for profitable operation from the first day as evidenced by the wide number of plants in successful operation the world over.

Depend on the Wemco Mobil-Mill — and the skills behind it.



WEMCO®

Western Machinery Company
650 Fifth St. • San Francisco, California
and throughout the world

PERSONALS *(Continued)*

William M. Frames, of Johannesburg, formerly chairman of Rand Mines Ltd., has been named chairman of International Nickel Co. S.A. (Pty.) Ltd., South African subsidiary of Inco Ltd. Mr. Frames will be chief executive officer of the company, which is opening new offices in the Palace Buildings, Pritchard St., Johannesburg. He will continue as a director of Rand Mines Ltd. with which he has been associated for 37 yr, and as a director of other companies.

Frames

D. J. Rogers has been made a consulting engineer for New Consolidated Gold Fields, Ltd.

The Honourable D. G. Shepstone, recently retired as administrator of Natal, has joined the board of directors of the Aluminium Co. of South Africa Pty. Ltd.

W. A. Robbins was made manager of mines and chief engineer of Great Northern Iron Ore Properties; **William W. Watson** became assistant manager of mines and **Herbert E. Thellin** was placed in charge of mine inspection in the Eastern district, effective July 1.

Donald V. Erickson and **Russell L. Dahl** have been appointed assistant superintendent and general maintenance foreman, respectively, of Oliver Iron Mining division's Extaca and Rouchleau ore sizing plants, Virginia, Minn., Mesabi range. **Stanley M. Lane,** former superintendent of American Smelting & Refining Co., East Helena plant (Mont.), is its new general manager. Lane succeeds **Joseph T. Roy,** who is now general manager of Asarco's Selby plant. **K. D. Loughridge,** assistant superintendent at the El Paso plant, replaces Lane as superintendent.

Lester R. MacLeod, mechanical engineer with Anaconda Co. in New York City, retired as of August 1. He started to work for the company in 1915, pausing to take a degree in 1919 from the University of Washington. After transfer to New York in 1930 he had major responsibility for mechanical design and for selection of crushing and conveying equipment for the Morenci Reduction Works, the Chuquicamata sulphide plant and the Erie Mining Co. taconite plant. Among patents issued to MacLeod are the power cable insulating machine, a hot copper rod coiler, a pneumatic transport system for fine solids, and gyratory crusher improvements.

P. J. O'Brien and **R. F. Steel** have been appointed to newly created positions of vice presidents of United States Borax & Chemical Corp. of production and engineering, and finance and administration, respectively. Steel, most recently assistant general manager, has been with the company for 12 yr. O'Brien, who joined the company in Carlsbad, N. M. in 1933, has served as general manager since 1956.

Paul H. Floyd, mineral process engineer, and formerly in charge of USBM's ore dressing laboratory at Albany, Ore., has joined Stanford Research Institute's chemical engineering section. Previously he was project engineer with the Utah Construction Co. and assistant mill superintendent of Sunshine Mining Co.

A. G. W. Lamont, formerly with A. H. Ross & Associates, is now with W. S. Atkins & Associates Ltd., Toronto, as chief process engineer.

William A. Blomstran has been named district manager of the Port Henry district, Republic Steel Corp., Mineville, N.Y., succeeding **Francis J. Myers** who has retired. Blomstran, a Michgan College of Mining and Technology graduate with a B.S. in mining, and a member of AIME, began his career with the Witherbee Sherman Co. in 1934. Since then he has been at the Mineville and Lyon Mountain, N. Y. properties of Republic as engineer, superintendent of mines and has done special appraisal work in Mexico, Canada and in the U.S.

Blomstran

S. K. Droubay has been elected vice president of United Park City Mines Co. He continues as general manager and a member of the board of directors. **Robert G. Dwyer,** Intermountain area counsel for Anaconda Co., has been elected to the board.

Edward D. Tierney, general superintendent of Anaconda Co.'s Great Falls (Mont). reduction department, has been appointed an assistant to **Chester H. Steele,** vice president in charge of western operations. Tierney had previously served in Anaconda's Chilean activities for 20 yr.

Obituaries

Roger L. Strobel, c. 75, former superintendent of Asarco's East Helena, Mont. plant, died in Portland, Ore. He was with the smelter in the early 1920's, and until his retirement several years ago he was associated with Linde Air Products of Salt Lake City.

Donald Macy Liddell, 79, died Aug. 16 at New York Hospital. A well-known metallurgist, Mr. Liddell had discovered a selenium recovery method, authored "Metallurgists' and Chemists' Handbook," "Handbook of Chemical Engineering" and "Handbook of Non-Ferrous Metallurgy." In 1957, he received the Mining and Metallurgical Society of America's gold medal for contributions to metallurgical research. After graduation in 1900 from Johns Hopkins University as a chemistry and physics major, he did engineering work for various mining companies. From 1910 to 1916, he was editor of *Engineering and Mining Journal* of New York. After World War I he became a partner in Weld & Liddell, New York, which concern was dissolved in 1936. Mr. Liddell maintained his own consulting engineer practice at 11 Broadway from 1936 until his retirement last year.

William H. Ziegler, 77, died Aug. 5 in Minneapolis, Minn. He was chairman of the board of Wm. H. Ziegler Co., Inc., mining and construction equipment distributors.

Frank J. Grout, 78, well-known geologist, died Aug. 1 in Minneapolis, Minn. A professor of geology and mineralogy at University of Minnesota for 40 yr when he retired in 1948, he had since taught at various universities and had done geological field work.

Michael P. Cloonan, prominent Colorado mining engineer, died aboard a plane en route to Washington. He was past president of Colorado Mining Association and a member of Colorado Natural Resources Committee and a director of Colorado Metal and Mining Fund.

Luther C. Brewer, 78, Duluth, former general manager of Newport Mining Co., Ironwood, Mich. until 1914, died July 17. He was later associated with Townsite Mining Co. and Coates & Tweed.

Thomas M. Bains, 80, mining and metallurgical engineer, graduate of Columbia University, class of 1911, died Aug. 14 at Veterans Hospital, Napa, Calif. After working in various mines in California, Arizona, New Mexico and Mexico, he joined General Electric Co. in Schenectady and later served as associate professor in Case School of Mines, at University of Minnesota, Colorado School of Mines, and Oregon State College. In later years he worked on the Pacific Coast as a mine examiner for Reconstruction Finance Corp. During World War II he was principal economist in the tin, lead and zinc section of the WPB. In more recent years he was in mining at Whitlock, Calif.

Malcolm W. Mouat, 77, a mineral engineer and geologist, died Aug. 19 in Columbus, Mont. He was an owner of the Stillwater (County) River chromite claims.

Frank Waltar, manager of the Gold Eagle Mining Corp., and head of operations at Gold Eagle silver-lead mine east of Tonopah, Nev., died in early August.

Mason L. Bingham, 60, chairman of the board of Oregon State Department of Geology and Mineral Industries, died Sept. 4. Bingham was president of Benton Mines, Inc., and was an associate member of the AIME.

Here's why WEST END can answer an inquiry on your particular specifications immediately!

When you require special data on a WEST END product and phone for information, the Sales Office Manager in Oakland with whom you speak can contact the plant at WEST END immediately. He talks by private wire teletype with the Technical Director and receives an authoritative answer immediately. It is relayed to you often while you are still on the phone.

WEST END 's Sales Office Manager sales representatives and plant executives work together as a team manning a system that is, in our opinion, uniquely outstanding in the chemical industry. Their confidence in the efficiency of this system is reflected in the enthusiastic, helpful and friendly manner in which they promptly serve you . . . our customers.

WEST END CHEMICAL COMPANY
DIVISION OF STAUFFER CHEMICAL COMPANY
1956 WEBSTER, OAKLAND 12, CALIF. • PLANT, WESTEND, CALIF.

SODA ASH
SODIUM SULFATE
BORAX · HYDRATED LIME

Submarines May Transport Canadian Iron Ore

RESEARCH INTO UNDERSEA FREIGHTING by submarine through the northern Candian port of Churchill is being speeded up, states F. G. Mitchell, chairman of the British firm of Mitchell Engineering Ltd.

Studies commissioned by Saunders-Roe to determine the cost and economic feasibility of carrying iron ore from the Hudson's Bay ocean port to the United Kingdom will now be pushed to completion before the May 31, 1959 deadline originally projected.

Success of the U.S. Navy's *Nautilus* and *Skate* in crossing the Arctic Ocean under ice means that Churchill, closest salt-water harbor for the Canadian and United States northern plains area, could become a 12-months' port, states Willis A. Richford, of Saskatoon, executive director of the Hudson's Bay Route Association.

Shipping from Churchill at present is confined to a 2½-months' mid-summer season. Main outgoing cargoes consist of grain. Incoming ships bring miscellaneous imports and, most notably this year, 18,000 tons of nickel concentrate destined for Fort Saskatchewan near the Rocky Mountain foothills.

A U.S. Air Force rocket and upper atmosphere testing base is also located near Churchill and supplied partly via the ocean route, partly by rail freight on the single-track Canadian National Railways line which runs 511 miles northeast from Regina, midpoint in the northern plains area.

Both the Hudson's Bay Route Association and the Saskatchewan government recently requested the Canadian government to enlarge facilities at Churchill to cope with a slowly increasing demand. Specifically, requests called for three more berths, enlarging and deepening the turning basin, a multipurpose 75-ton hoist, and more elevator grain cleaning and storage space.

The Association estimates savings of 17 to 23c per bushel in wheat shipments overseas from the Canadian western prairies where undersea freight shipments proved to be technically feasible. The most important reductions in imports into the area would be in heavy machinery and automobiles.

Saunders-Roe retained Mitchell Engineering Ltd. early in the year to investigate whether it was feasible to use submarines with nuclear power for freight shipments out of Churchill. According to Mr. Mitchell, Saunders-Roe will compare relative costs of submarine and surface vessels of various sizes, speeds, and payloads, make studies on optimum shapes, consider methods of docking and operating submarines.

The present shipping season at Churchill varies and is actually longer than 2½ months, but insurance rates are one important factor that holds ship movements to the safest 10 weeks. This year the first cargo boat entered the port on July 25. By July 31, five freighters had unloaded 20,000 tons of imports and cleared out carrying 1,700,000 bushels of grain. About 50 ships enter before insurance closes on October 20.

Government-owned grain terminals at the port have a storage capacity of 5-million bushels. Their record of loading almost 2-million bushels in a week would indicate present facilities could load 100-million bushels if the first week's tempo were maintained.

Last year only slightly more than 17-million bushels were shipped out before ice closed the port to shipping. But other bulk shipments are developing; last year the port's six-berth pier was altered to accommodate oil tankers, and this year a large tank farm and a pipeline were built.

Bolivia Seeks Economic Firmness

NEGOTIATIONS to put teeth into Bolivia's economic stabilization plan were reported progressing satisfactorily, according to *The New York Times*.

The new measures that are adopted to stiffen the economy will probably become a major political issue, with the Left-wing government party and the opposition Rightist parties seeking to exploit them for political advantage.

President Hernan Siles Zuazo appears to be ready to fight for the plan with the backing of his new minister of government, Walter Guevara Arze.

The negotiations have been carried on between an International Monetary Fund Mission headed by David Finch and government financial officials. Mr. Finch is an Australian who heads the South American Division of the Fund.

Victor Rose, a former First National City banker who is an adviser to the Bolivian Stabilization Commission, also took part in the talks.

The stabilization progam has been backed since it began twenty months ago by reserves of $5-million provided by the Monetary Fund and a $7.5-million stand-by credit from the United States Treasury. Direct aid from the United States International Cooperation Administration this year has totaled $20-million, in addition to $3-million for technical aid.

Bolivia has been seeking additional aid from the United States to help the government over an emergency situation created by a decline in income from mineral exports, particularly tin. Soviet tin sales reached 9,000 tons in the first half of this year and the International Tin Agreement's price stabilization plan was endangered.

The United States Governent has told Bolivia that the Bolivian budget and other policies toward stabilization will be considered in its attitude toward the requests for new aid.

While sympathetic to Bolivia's tin problem, the negotiators are expected to insist that the Government adopt measures to balance the budget, devaluate the Boliviano to its real level in the free market, foster further private investment opportunities and break the labor union stranglehold on employment.

Union influence in the government, which stems from the National Revolutionary Movement's revolution of 1952, has been very strong, particularly in the mines, from which many revolutionaries began the fight.

By overthrowing the government and nationalizing the tin mines, the revolution broke the political hold on the tin mining companies on the Bolivian government. But the Bolivian Mining Corp., the state-owned entity that runs the tin industry, has an annual deficit of $10-million.

Of the sixteen mines operated by the corporation with 27,000 miners, at least ten are considered uneconomic. Under the law, however, miners cannot be discharged. Similar non-dismissal clauses affect the railroads, which have been hard hit by the 40% decline in mineral exports since 1956 and are operating with a large deficit.

The stabilization plans call for the dismissal and the relocation of miners so that only efficient miners will be left.

S. Africa to Get a New Ferromanganese Plant

SOUTH AFRICA'S MANGANESE ore producers and the whole economy of the Union stand to gain heavily from the establishment of a Natal ferromanganese plant which is due to come into production at the end of next year.

The Ferralloys Ltd. plant is at Cato Ridge, not far from Maritzburg, capital of the province, and Durban. Construction of a 2.5-billion gal dam has already begun. Imported machinery and furnace equipment is beginning to arrive and preliminary work has started.

The decision to establish a ferromanganese plant was taken to meet the opposition of the Union government to the export of large quantities of high-grade manganese ore. Exports of this material were restricted to 44,000 tons in 1954. The export ceiling was raised to 60,000 tons in 1956. But although there has been a slackening of world demand in the last year or two, weight for weight ferromanganese commands a far greater price than manganese ore and the demand is much greater.

(Continued on p 137)

DROTT 4-IN-1 SKID SHOVEL built lighter and stronger with USS "T-1" Steel. Can be used as a bulldozer, bull-clam shovel, clamshell or skid shovel. Can load trucks or freight cars.

"T-1" Steel reduces weight of 4-in-1 bucket by 35%, boosts payload by 1,200 pounds

"Our engineers specified USS 'T-1' heat treated alloy steel in the construction of our 4-in-1 skid shovel bucket because we could reduce the original weight by 35%. What's more, we could add one-half yard to the bucket capacity," says Mr. Edward Drott, President and Chief Engineer, Drott Manufacturing Corporation, Wausau, Wisconsin.

The entire Drott bucket is fabricated from USS "T-1"* Steel which has a minimum yield strength of 100,000 psi, nearly 3 times that of structural carbon steel. This strength helped to make the weight reduction possible . . . and the reduced weight on the front end of the tractor improved the balance and increased efficiency.

50% longer wear. Drott buckets made of "T-1" Steel have now been in rugged service about two years. Because of "T-1" Steel's high resistance to impact abrasion, the buckets will last 50% longer than those made of lower strength steel.

Strength after welding. USS "T-1" Steel was found to retain its strength after being welded or flame cut. This was an important factor in design.

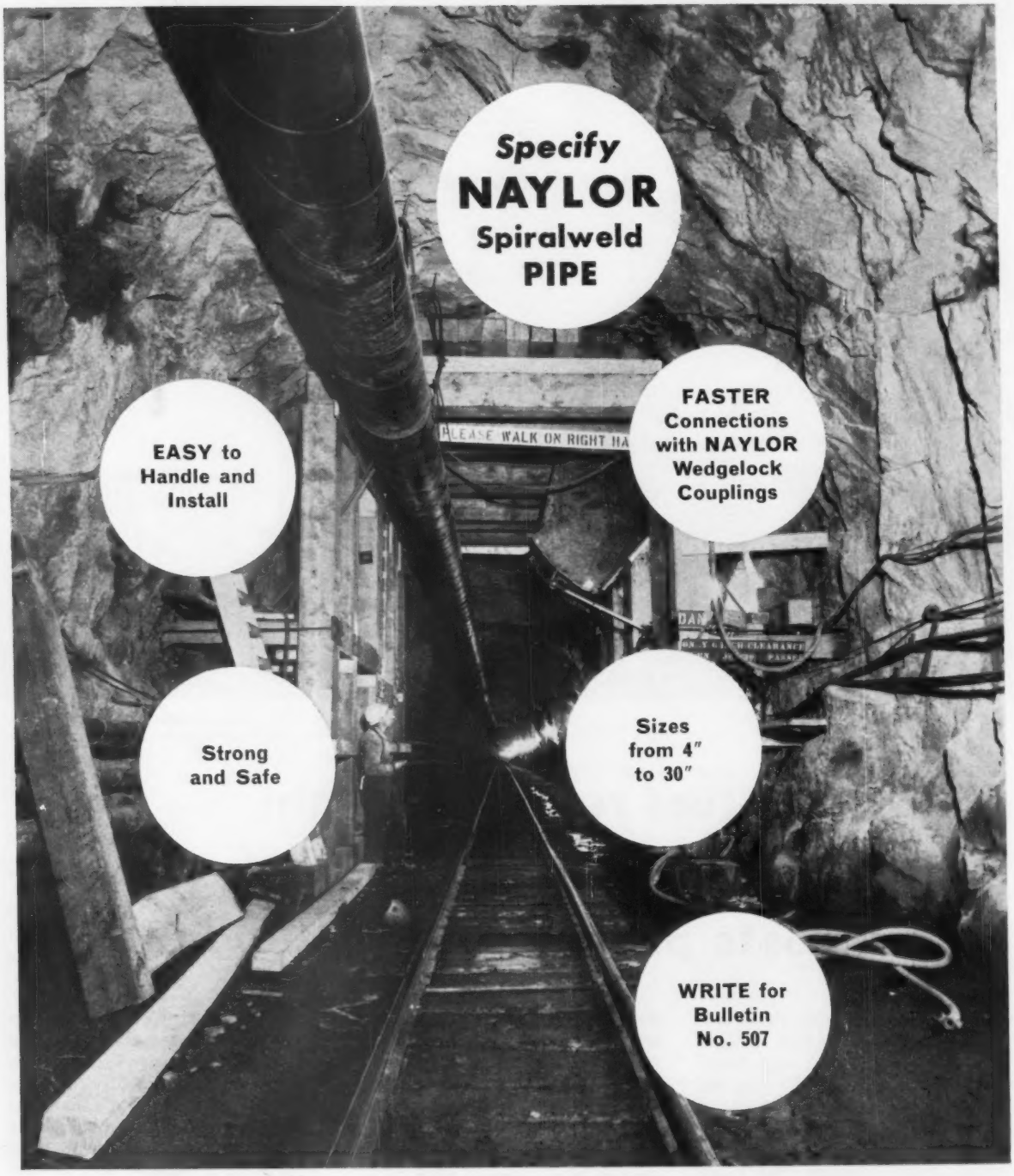
Sub-zero toughness. Even at 50° below zero, USS "T-1" Steel retains its high resistance to shocks and jolts in rugged work.

Build better with USS "T-1" Steel. No other steel possesses the remarkable combination of high yield strength, toughness and weldability found in "T-1" Steel. It may be the answer to your problems for many different types of mining and construction equipment. *Remember that we also make* USS COR-TEN*, USS TRI-TEN* *and* USS MAN-TEN* *high strength steels . . . standards for heavy-duty equipment.* United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

**Registered trademarks.*

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Ala.
United States Steel Supply—Steel Service Centers
United States Steel Export Company

USS United States Steel



NAYLOR PIPE Company

1243 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

Ferro *(Continued)*

Ferralloys plans to spend $5.88-million on plant and auxiliary undertakings which will cover a 905 acre area. When the plant is fully established, the company expects to earn up to $5.6-million annually in foreign exchange.

Brinco Optimistic About Its Labrador Uranium Ore

HOPE THAT FURTHER ORE will be found in a small but unusually rich uranium deposit in Labrador was expressed in the annual report of British Newfoundland Corp. Ltd. (Brinco).

In the president's letter to shareholders, B. C. Gardner said:

"Although we have not found enough of it to make a mine sufficiently attractive under conditions currently governing the uranium market, indications are that further exploration will uncover additional ore."

During the year under review Brinco's mineral exploration subsidiary, British Newfoundland Exploration Ltd. (Brinex) expanded exploration on its own account and with partners. Much of the work was done in the major Kaipokok-Makkovik mineralized belt in northeastern Labrador. This belt contains occurrences of copper, uranium, thorium, molybdenum, silver, lead-zinc, columbium and beryllium.

Six leading Canadian companies participated with Brinex in exploring nine separate areas of Labrador and Newfoundland ranging in size from 60 sq miles to 2,500 sq miles. These companies were: New Jersey Zinc Exploration Co. (Canada) Ltd.; Canadian Johns Manville Co. Ltd.; Sogemines Development Co. Ltd.; Asbestos Corp. (Explorations) Ltd.; the Consolidated Zinc Corp. of Canada Ltd., and Gresham Exploration Ltd.

The report said the uranium deposit—known as the Kitts prospect—is estimated to contain "a substantial tonnage" of ore grading 0.709% U_3O_8, or 0.518% after allowing for dilution and the reduction of high assays. It is in the Makkovik area near the coast of Labrador about 125 miles north of Goose Bay.

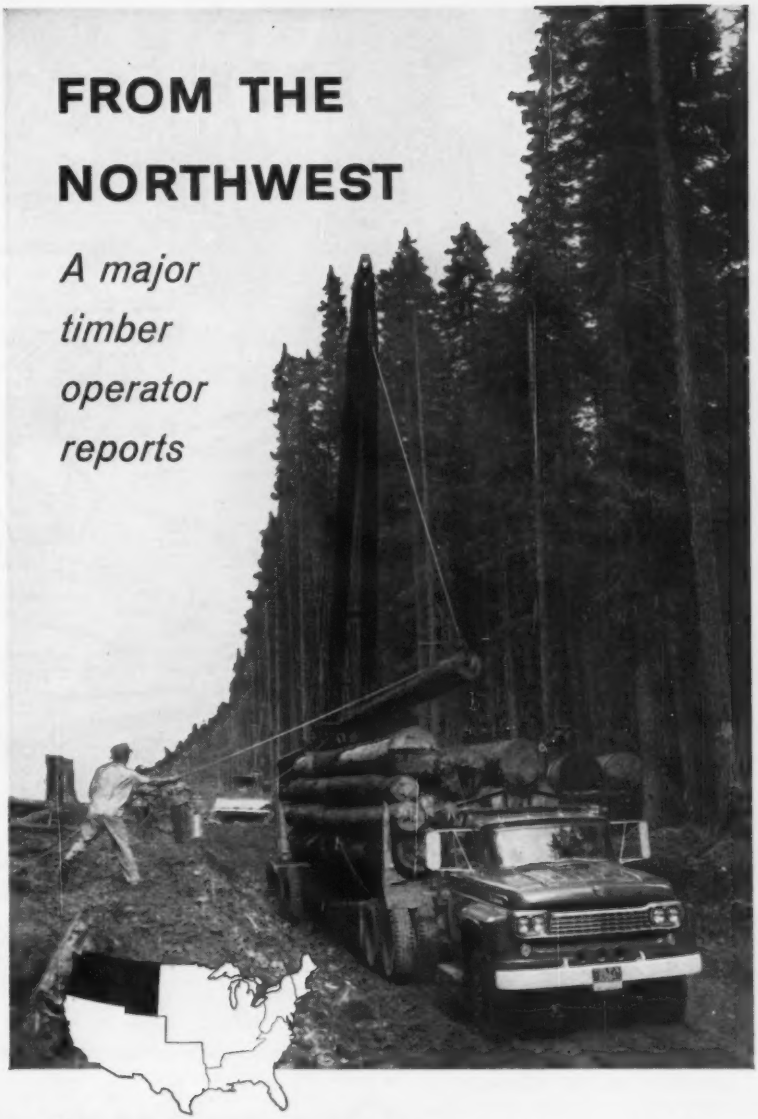
Development work so far totals approximately 21,500 ft of diamond drilling and 2,280 lineal ft of underground development. The ore reserves blocked out are in two shoots extending to a maximum vertical depth of 500 ft. The orebearing structure is open laterally and at depth, and possibilities for additional ore are considered good in both dimensions.

In the Kaipokok-Makkovik belt new discoveries of uranium-bearing mineralization as far west as Moran Lake extended the known area favorable for uranium occurrences to about 2,500 sq miles.

Under the provisions of an agreement with the Newfoundland government, Brinco renewed its mineral exploration lease last April for a further period of five years. During this period $1.25-million will be spent on further exploration and investigation.

FROM THE NORTHWEST

A major timber operator reports



Steve Wilson's company hauls logs from mountainous Oregon timber stands—over crude roads with grades up to 18%.

Mr. Wilson has 43 Ford trucks and tractors that haul nearly 300,000 board feet of logs and rough lumber a day.

"I can't think of a tougher job for a truck than my operation," says Steve Wilson. "I need trucks that can take punishment and *stay* on the job. If a load of logs isn't delivered on schedule, I can lose plenty."

The tractor in the picture is a 1958 Ford T-850.

It is powered by a 534-cubic inch V-8 engine. Rear axle ratio is 6.69 to 1, wheelbase is 192 inches. It is equipped with a 5-speed main transmission and a 4-speed auxiliary, and grosses 72-76,000 pounds.

"Diesels used to walk right around us, but today it's just the opposite. This big Ford climbs a 10% grade loaded at 11 miles an hour, compared to 6 mph for our previous truck."

S. O. Wilson

President
Steve Wilson Company

Ore processing called for stout "muscles"

Iron-shod stamps relieved men of the back-breaking task of crushing ore with a hammer. But these primitive replacements for muscle power required long and tedious workmanship, were clumsy and difficult to operate and still produced only small quantities.

Today's ore processing plants use the muscle power of efficient grinding mills to turn out many tons of processed ore per day. Many mill users specify and insist upon CF&I Grinding Balls and Rods for their mills because the steel has the ideal toughness-hardness balance that assures optimum grinding ability plus maximum wearability.

5098

THE COLORADO FUEL AND IRON CORPORATION

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Casper • Chicago • Denver • Detroit
El Paso • Ft. Worth • Grand Junction • Houston • Kansas City • Lincoln (Neb.) • Los Angeles • New Orleans • New
York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City • San Antonio
San Francisco • San Leandro • Seattle • Spokane • Wichita

CF&I

Krupp-Renn Pellets Feed Hot-Blast Cupola

THE GERMANS, original continuous hot-blast cupola designers, have done well with it at the Gusstahlwerk Witten operation, a report on which is presented in the September 1958, issue of *Journal of Metals*. The article summarizes a paper by Adolph Richter, George Cohnen and Paul Jacobi.

To increase alloy steel output, the plant installed a basic hot-blast cupola whereby scrap is melted and which is charged either into an open-hearth or into an LD oxygen converter, used largely for duplexing with electric-arc furnaces. The 23-metric-ton-per-hour cupola has proved successful in combination with these units in producing high-quality steels.

"The hot-blast cupola furnace has been run on charges differing in composition. The reduction of ores is possible to a limited degree. A test made with Krupp-Renn pellets pointed to the possibility of using such pellets in quantities of up to 40% with a proportional decrease in cost resulting.

"The charging of liquid cupola iron in the open-hearth steel plant has brought about the expected drop in specific heat consumption and an increase in furnace efficiency. The use of LD blown steel for duplexing has resulted in a remarkable decrease in the consumption of both electrodes and current in the electric arc furnaces."

It is pointed out that there now are at least 24 hot-blast cupola plants in the world, including those in India and Egypt, "where they represent a considerable capital saving." Foundations for the first hot-blast cupola-LD converter combination in the United States are being laid at Acme Steel Co., Chicago. Scheduled to be in operation early in 1959, the plant will make use of scrap for the production of hot metal, which will be blown into steel in two 50-ton capacity LD converters. The unit copies the Gusstahlwerk Witten plant.

New Jersey Zinc Expands, Builds Spiegeleisen Unit

NEW JERSEY ZINC CO. is well into a major expansion of ore roasting and sulphuric acid production facilities at Palmerton, Pa. smelter. When completed in 1959, New Jersey Zinc will have materially increased its roasting capacity and will have raised acid production by an additional 40,000 annual tons. Increase in production of sulphide ores from company's mine in Virginia, Tennessee and Pennsylvania made program necessary.

Horse Head has just completed the first phase of research and engineering at Palmerton on its recently developed Sterling Process for spiegeleisen. Furnace has been designed to recover manganese and iron from zinc deposits at Ogdensburg, N. J. Prototype furnace has been in operation over past two years. Over 600 tons of spiegeleisen have been produced to date.

FROM THE SOUTHWEST

A major oil-field operator reports

This '58 Ford F-850 runs all day . . . but hardly moves at all.

It belongs to the Stevenson Drilling Company of Houston, Texas. The truck goes only a few miles a day but its V-8 engine runs all day long—powering (transmission PTO) a drill that's searching for oil. The combination air-water drill makes 100-ft. deep "shot holes." The oil company geophysicists detonate dynamite in these holes for seismograph recordings that reveal the location of new oil deposits.

"We are really impressed with the way these new Ford Super Duty V-8's are engineered," says W. M. Stevenson. "We normally drill on propane, through a truck's carburetor throat, but the fuel costs of our Super Duty V-8 turned out to be so reasonable that we didn't need to switch."

The Super Duty V-8 power plant in the Stevenson Company's F-850 displaces 401 cubic inches. It has a 5-speed transmission and a two-speed rear axle ratio of 6.50/8.87 to 1. Wheelbase is 175 inches, gross weight 23,000 lb.

"We have used Fords since 1946. We like the availability of Ford replacement parts, their low cost and the excellent Ford service. I plan on buying Ford trucks 100% in the future."

W. M. Stevenson

President
Stevenson Drilling Company

Roebling Presents

THE NEWEST CONCEPT IN WIRE ROPE

*Herringbone**

two ropes in one!

Here is a combination that has proved itself during three years of field testing. A welcome addition to Roebling's great line of wire ropes, Royal Blue *Herringbone* is both a regular lay and lang lay wire rope!

So, in one rope you have the greater flexibility and abrasion resistance of lang lay construction *plus* regular lay's superior stability under severe operating conditions.

Preformed Herringbone is made of two *pairs* of lang lay strands, and two strands of regular lay which separate the two pairs of lang lay—all of it made of Type 1105 rope wire.

For three years Herringbone has been used for general hoisting, holding and closing lines, shovel ropes, wagon scraper ropes and dragline ropes. Without reservation, its performance has been superior to that of any other rope used for the same jobs . . . even in the hands of inexperienced personnel! *Its proven capabilities clearly suggest its use for all jobs where steel core ropes are normally used.*

See your Roebling salesman for all the facts or write Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey. Roebling Herringbone, the two-in-one rope to meet the *doubly* stringent demands of today's economy.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

**Reg. app. for*

HERRINGBONE
WIRE ROPE

Haulage Curbs Area's Mineral Development

THE MINERAL RESERVES of the seven-state Intermountain Region can supply the needs of the growing chemical industry for many decades, V. E. Larson, of the Food Machinery and Chemical Corp., Pocatello, Idaho, recently stated. He also said that there is a possibility of an aluminum industry developing in the Region.

Although the mineral reserves are huge—in some cases the greatest percentage in the United States—the mineral industry is hampered by lack of and cost of transportation, Mr. Larson told the 38th Annual Meeting of the American Institute of Chemical Engineers.

The Region, which includes the states of Montana, Idaho, Utah, Nevada, Colorado and New Mexico, has vast deposits of natural gas, oil, coal, oil shale and gilsonite; adequate amounts of iron, copper, lead, zinc, etc., and great abundance of limestone, phosphate, sulphur sand salt and trona, he said.

"The basic problems confronting the mineral industry of the Intermountain Region," he said, "are not the lack of reserves and the low grade of the mineral desposits, but rather the lack of transportation facilities, and the long distance to market. Many good properties are undeveloped because it is not economically feasible to build a road or railroad into the property. Frequently, freight costs to market are higher than the value of the ore f.o.b. mine. This situation will not change appreciably in the near future; however, as local markets develop, new properties will go into production."

Copper Mine Installs Open Pit Skip Haulage

A SKIP HAULAGE SYSTEM which will cost more than $2-million will be installed at the open pit copper mine of Kennecott Copper Corp.'s Chino Mines Div. in Santa Rita, W. H. Goodrich, Chino general manager, recently announced at the mine office.

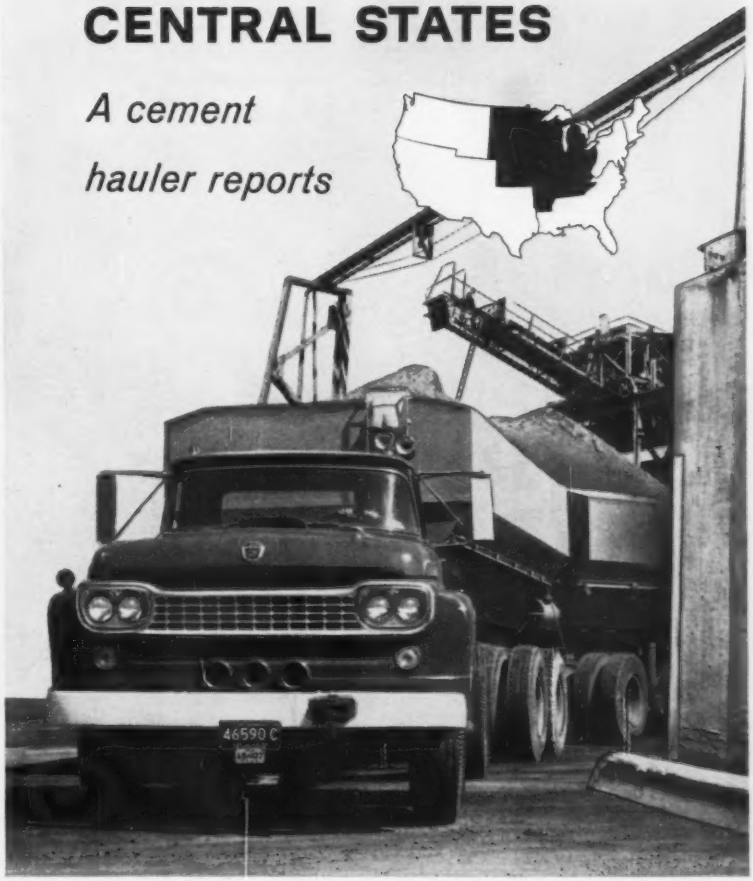
The new installation will be completed sometime next year. When constructed, the system will include two 40-ton capacity buckets which will be pulled by cables up an inclined track from the bottom to the top of the pit. The skips would have a hoisting capacity of around 18,000 tpd, assuming the material is hoisted the full length of the track.

Plans call for the skip to be installed in the southwestern portion of the pit where the vertical distance from the top to the bottom is approximately 600 ft. The ore buckets will be loaded by trucks at a station near the bottom of the mine. At one station, the skips will discharge waste. Ore will be deposited to another station. This material, in turn, will be moved either to the dumps or the reduction plant by train.

Goodrich said the new installation will enable the mine to haul more effi-

FROM THE CENTRAL STATES

A cement hauler reports



Carl Harrison, Inc., is a limited common carrier of bulk cement operating out of Dearborn, Michigan. The Ford F-1100 shown above is the biggest of the firm's six Ford trucks.

This F-1100 grosses 98-100,000 lb. pulling doubles. Payload is 64,000 lb. (170 barrels of cement). Company President Carl Harrison makes the point that the low curb weight of Ford trucks allows him to carry bigger payloads. "The curb weight of this Ford tractor is almost half a ton less than another make we have used on this job."

Carl Harrison's shrewd appreciation of efficient, economical equipment is further evidenced by the fact that his bulk cement semi-trailers are custom-built to his own design.

Additional specifications of this F-1100: 534-cu. in. Super Duty V-8, 5-speed transmission, 2-speed rear axle, 144-in. wheelbase.

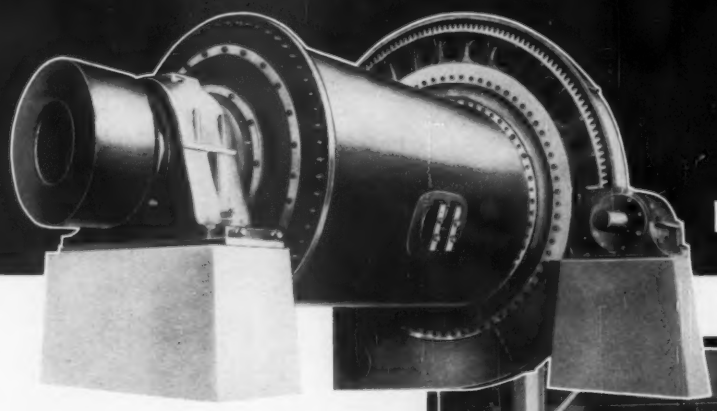
"And as far as power is concerned, this big Ford has really got it. She saves time on every trip, time that means money to us."

Carl Harrison

President
Carl Harrison, Inc.

TRAYLOR-MADE

is engineering proved

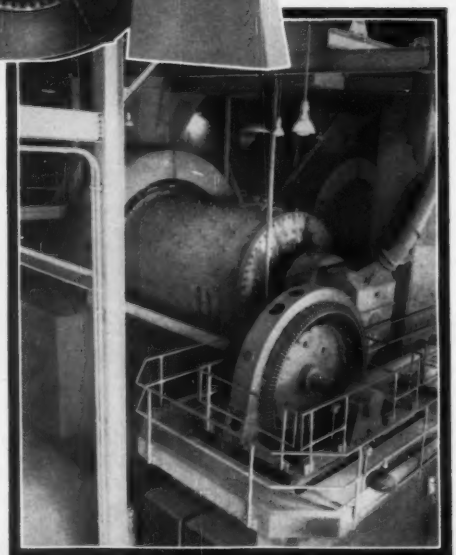


Traylor

BALL MILLS

Traylor-Made Grinding Mills feature shell liners of manganese or high carbon steel in plain, wave, cascade or Lorain type. The shells are of all welded steel construction, main bearings are made of Meehanite metal. Driving gears are steel, precision cut on our Maag gear generator. Mills may be fitted with drum feeders, scoop feeders or a combination of the two.

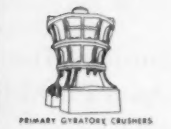
Traylor Grinding Mills are offered in a variety of types including Ball, Rod, Compartment and Tube Mills. Write for additional information.



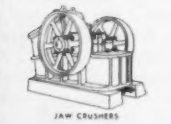
Traylor Ball Mills are made in two types—overflow and diaphragm discharge. They are built for either wet or dry grinding.

SECONDARY GYRATORY CRUSHERS

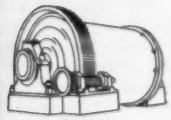
APRON FEEDERS



PRIMARY GYRATORY CRUSHERS



JAW CRUSHERS



BALL MILLS

ROTARY KILNS

Traylor

TRAYLOR ENGINEERING & Mfg. Co., 2001 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P. Q.

Chino Pit (*Continued*)

ciently from the lower areas which is becoming more expensive as the pit grows deeper. At the present time, trains are used to haul the ore and waste from the lower benches and this involves an increasing number of switchbacks as well as increased haulage distance.

Atlas To Merge Affiliates, Form Public Corporation

A PLAN TO MERGE the uranium affiliates of Atlas Corp. to form a publicly owned company in which Atlas will be the largest stockholder has been approved by directors of the concerns involved, Floyd B. Odlum, Atlas president, announced.

The Atlas uranium subsidiaries to be merged are the Hidden Splendor Mining Co., 100% Atlas; Lisbon Uranium Corp., about 76% owned; Rio de Oro Uranium Mines, Inc., about 61% owned; and Radium King Mines, Inc., about 30% owned. Also included in the merger is Mountain Mesa Uranium Corp. The surviving corporation will be the Hidden Splendor Mining Co.

The merged company will have gross assets of more than $50-million and will produce about half a million tons of ore per year. Its initial capitalization will consist of 12-million shares of common stock having a par value of 50c per share. Floyd B. Odlum, president of Atlas Corp., will be chairman and chief executive of the new company and A. P. Kibbe will be president. Mr. Kibbe is now president of Hidden Splendor.

Combined production of the merging companies in the first six months of 1958 was more than a quarter of a million tons of ore averaging approximately 0.36% U_3O_8 in grade. The companies being merged have five operating mines, Hidden Splendor's Almar mine, Lisbon's Ike and Columbia mines, Rio de Oro's Dysart mine, and Radium King's Red Canyon mine. A sixth mine, in the Gas Hills area of Wyoming, is planned to go into production early in 1959.

The constituent companies have major ore bodies in the Big Indian District of Utah, the Ambrosia Lake area of New Mexico, and the Gas Hills area of Wyoming, as well as a substantial number of other properties, many of which are now under exploration and development.

The merged company will also have interests in two uranium mills, the Uranium Reduction Co. mill at Moab, Utah, and the Homestake-New Mexico Partners mill near Grants, N.M. The Uranium Reduction Co. mill, which processes the ores from the Hidden Splendor and Lisbon mines in Utah, has just negotiated an extension of its contract with the Atomic Energy Commission from 1962 through 1966.

The merger is subject to Securities and Exchange Commission requirements and approval by the stockholders of the companies involved. It is expected that stockholder approvals will be obtained and the merger consummated before the end of the year.

FROM NEW ENGLAND

A nationally operated dairy reports

"Milk and dairy products make highly concentrated loads," says Elnathan Mitchell, President of Mitchell Dairy. "We need a bigger, stronger tractor than usual for our gross of about 50,000 lb. We decided to try a new Ford Tilt."

Mitchell Dairy, an affiliate of The Borden Company, has headquarters in Bridgeport and serves almost the entire state of Connecticut. The dairy's Ford C-1000 Tilt is on the job seven days a week, hauling canned and bottled milk from Bridgeport to outlying distribution plants.

This big Ford operates both in heavy city traffic and on expressways. Comments of drivers: "She makes it really easy to handle trailers in tight areas". . . "There's practically no shifting once she gets up to cruising speed". . . "Outpulls any tractor in the fleet."

Mitchell's Ford C-1000 Tilt Cab tractor has a 477-cu. in. V-8, five-speed transmission, 6.71/9.13 to 1 two-speed rear axle ratio, 99-inch wheelbase.

"We bought this Ford Tilt Cab truck chiefly because of its maneuverability and its low curb weight—over 1,000 lb. lighter than competitive tractors. That means our legal payload can go better than 30,000 lb."

Elnathan Mitchell

President
The Mitchell Dairy Company

open motors for extreme conditions

Save up to 60%!

Here's an amazing advance in motor technology! It's the *Super-Seal* motor line — an open motor design so completely unaffected by moisture, dust, dirt, oil, acids and alkalis that it can be used in many applications previously requiring more costly enclosed motors. *Savings range from 15 to 60%.*

Super-Seal motor superiority results from revolutionary insulating techniques. Available in any integral horsepower size, smaller *Super-Seal* motors incorporate an encapsulated stator. A durable epoxy resin encloses the stator, creating an electrical system impervious to outside elements.

In larger sizes, *Silco-Flex* insulation is used. In this system, silicone rubber is vulcanized into a homogeneous mass to form a flexible, moisture and heat resistant, void-free dielectric barrier around coils and leads.

Both of these insulation systems are unsurpassed. Proof? An encapsulated motor ran for hundreds of hours at full load in a 4% brine solution.

Find out more about new economies in motors from your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin. *Silco-Flex and Super-Seal are Allis-Chalmers trademarks.*

ALLIS-CHALMERS A-C ALLIS-CHALMERS

A-5802

Russians Use Isotopes in Blast Furnace Studies

GENNADI LUKASHEV, chief engineer, Azovstal Iron & Steel, in the Ukraine, reports that they have been studying the charge descent in a blast furnace, and regulating the passage of the charge with the aid of charge lumps made radioactive with reactor isotopes.

In addition, he reports that refractory linings in the blast furnace can be watched for deterioration by making certain wall points radioactive and watching the wear pattern with radiation counters. Isotopes are planted during repair campaigns.

New Plan Separates Near-Microscopic Diamonds

THE DIAMOND RESEARCH LABORATORY in Johannesburg, operated by De Beers and other members of the international diamond producing group, has devised a process for separating diamonds scarcely visible to the naked eye from samples up to 5 lb taken from alluvial deposits. Diamonds of 1/400th of a carat (0.00002 oz avoirdupois) have been quickly recovered by this technique.

The normal method employed on the mines to recover diamonds by passing the diamondiferous concentrate over grease could not always be applied because diamonds from alluvial deposits do not in most cases adhere to grease unless they are specially treated. The method employed to recover these diamonds was described in a recent issue of the *Journal of South African Institute of Mining and Metallurgy*.

The first stage involves reducing the bulk of the sample through milling. This breaks down the gravel and other soft materials into mud which can be washed away. The milling also cleans any diamonds present, facilitating their recovery.

The residue is again reduced, either by electrostatic or heavy liquid separation, or both, depending on the size of the particles which remain after milling.

Fairly large particles are passed through an electrostatic field in which the diamondiferous-bearing portion is separated from the remainder of the sample.

Samples containing smaller particles are separated by the use of heavy liquids (bromoform and a supersaturated solution of lead sulphamate). In the case of the former, which has a specific gravity of 2.85, the heavy particles and the diamonds sink and the lighter materials can be skimmed off.

The specific gravity of the second liquid is variable, depending on its temperature. At the diamond industry's Johannesburg laboratory, it is kept at 80 deg C, where it has a specific gravity of 3.64. At this level the diamonds float and can be skimmed off.

By the application of one of these methods, or a combination of them, the average sample is reduced to about one-tenth of its former weight and the remaining portion is then sorted by hand.

FROM THE MIDDLE ATLANTIC STATES

A dump truck operator reports

"I operate all over New York State," says owner-operator Wendell Wilbur, "and loaded or empty my Ford can beat any dump on the job."

Mr. Wilbur's big 1958 Ford T-850 has a 10-cu. yd. dump body, is powered by a 477-cubic inch V-8, grosses 50,000 lb. It is equipped with 5-speed main transmission, 3-speed auxiliary, and has a 156-inch wheelbase.

"I'm in this truck all day long," says Mr. Wilbur, "and it's the smoothest riding ten-wheeler I've ever driven. And talk about handling!—with power steering my rig handles easier than a lot of pickups.

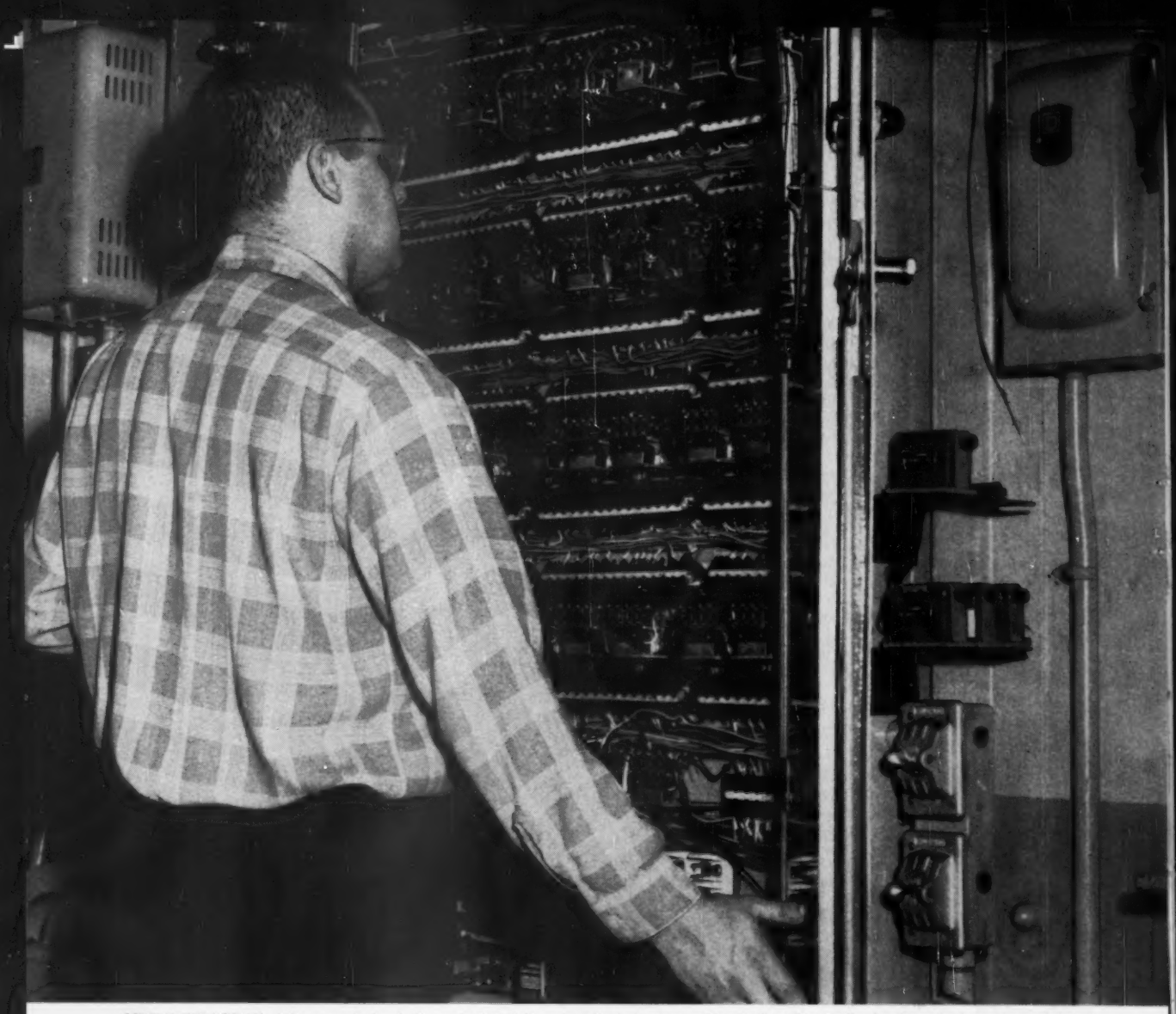
"This Ford's curb weight is almost 4,000 pounds less than other comparable trucks. That means more money-making payload for me."

Mr. Wilbur has been a truck user for more than twenty-five years, and he's been a Ford user just as long.

"My Ford T-850 has real power—on the hills I can pull away from any truck around—I even leave big diesels behind."

Wendell Wilbur

Owner-Operator
Ellenville, N.Y.



BEHIND THE SCENES at the new electronically controlled, fully automatic factory for making Du Pont Electric Blasting Caps (both regular and delay).

Automatic loading and electronic controls give you Du Pont Electric Blasting Caps that are even more reliable, more uniform than before

Let us take you behind the scenes at the world's most modern blasting cap plant. Then, you'll see why Du Pont Electric Blasting Caps, both regular and delay, are years ahead in reliability, uniformity and dependability.

Any possibility of human error has been completely erased from this scene. Every step in the process, from automatically loading the shell (and inspecting it 3 times during loading alone), to applying the shielded shunt and paper band is controlled electronically.

This revolutionary approach means that every Du Pont electric blasting cap—regular or delay—*must* meet our rigid standards at *every step* or it will be automatically rejected by one of the dozens of electronically controlled "watchmen."

This elimination of the human equation means that all Du Pont Electric Blasting Caps are even more uniform, more reliable, more dependable than ever before.

And you get all these benefits at NO INCREASE IN COST. Call your Du Pont representative or write to E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

DU PONT BLASTING CAPS

DU PONT *Products of Du Pont Research*

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Diamonds (*Continued*)

A 6.5X wide field binocular microscope is used to sort the smaller particles.

To ensure that diamonds are not lost in the process, identifiable "tracer" diamonds are added to some of the samples and these must be found by the sorters on the first attempt. If not, the sample is resorted. The sorters are not told which samples have been "salted". Since the new process has been in operation only one of the tracer diamonds was not recovered. It was broken in milling.

Peru's Santander Pit Is Nearing Production Stage

DEVELOPMENT OF THE SANTANDER MINE, a lead-zinc-copper-silver deposit owned by the Cia. Minerales Santander Inc., of Peru, is now nearing completion and is scheduled to be ready for operation this month.

The property has a proven reserve of 4-million tons of ore based on the results of diamond drilling carried out by the New Verde Co. in 1929-1930, and there is an additional possible reserve of 3-million tons according to calculations made by Mr. Edgar R. Lee, chief geologist of the St. Joseph Lead Co., who inspected the area early in 1957. The cost of the power plant, the 500-tpd assay selective flotation mill, and to place the property in operation will come to $1.8-million.

Santander ore runs 12% Zn, 2½% Pb, ½% Cu and 3 oz Ag per ton of ore, but surface ore which will be mined for the first one or two years will run much higher in lead, zinc and silver. The hydroelectric power plant has been completed to produce 1500 kw, though this can be increased to 4000 kw.

Construction of the access roads, campsite to house 150 men and supervisory personnel and other facilities have now been completed. Some 3-million tons of ore will be mined by open pit method. It is estimated that 1.3 tons of waste material will be removed for each ton of ore. Actual stripping was started some time ago and used in construction while stripping of the ore body itself has been going on for the past six months. There is now some 4,000 to 5,000 tons of ore ready to be moved to the mill.

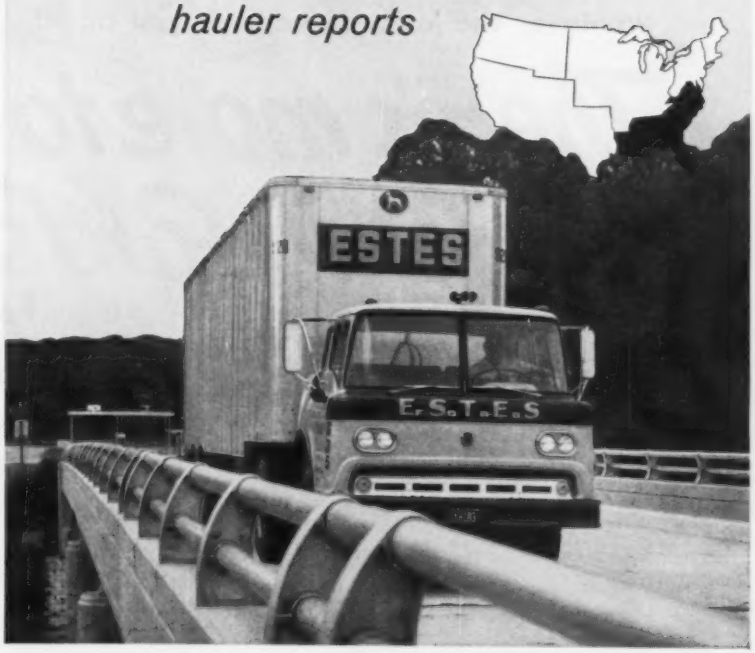
Development of the Santander mine was started in 1956, prior to the world drop in the price of lead and zinc, and a decision has just recently been made to the effect that the mine will be operated and is expected to start production before year end.

East-West Trade Study

EAST-WEST trade regulations are being revised, slowly, by Commerce Department in cooperation with U.S. industry representatives from the World Trade Advisory Council. The new regulations, which will make it easier for exporters to ship nonstrategic items to Iron Curtain countries (but not to Red China) stem from a recent relaxation of NATO controls.

FROM THE SOUTHEAST

An over-the-road hauler reports



Estes Express Lines, of Richmond, Va., owns a 1958 Ford C-1000 Extra Heavy Duty Tilt Cab model. This rig is on the job 20 hours a day, piling up ten thousand miles a month.

Robey W. Estes, Vice President and General Manager, calls the performance he's getting from his new Ford Tilt "outstanding."

"The economy of Ford's 477-cubic inch V-8 compares very well with the 450-cubic inch sixes in our fleet," he adds. "The Ford performs better and doesn't use any more gas. We get over 5 miles per gallon, which is pretty good for our gross and our kind of hauling. The Ford also has a lot more power and speed. As one of the drivers told me—that Ford gets down the road mighty easy."

Estes Express's big Ford is a 1958 C-1000 tractor, with a 477-cubic inch V-8 engine. It has a 99-inch wheelbase, a five-speed transmission and a two-speed rear axle ratio of 6.14/8.36 to 1. Gross weight runs from 52 to 56,800 lb.

"Ford's Tilt Cab design gives us as much as 1800 pounds more payload than we could get with a conventional tractor. Drivers prefer the Tilt because of its comfort and maneuverability."

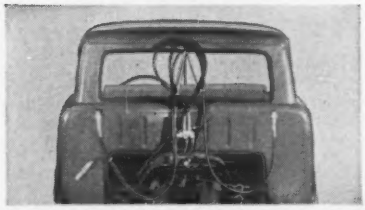
Robey W Estes

Vice President and General Manager
Estes Express Lines

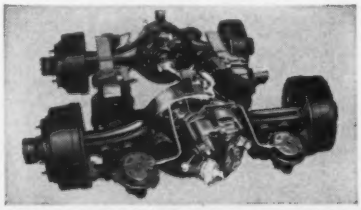
Whatever the job . . . wherever you do it!

There's more to look for in Ford's extra heavies for '59

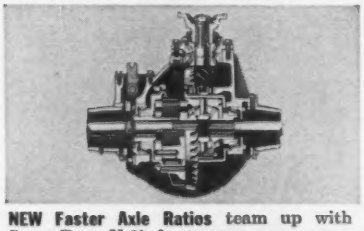
Ford Extra Heavies have proved themselves on every kind of job—you can count on them for *dependability* and *durability*. And in '59, you get high performance at low Ford prices for brand-new reasons! New faster rear axle ratios, new higher capacity axles, and other important options make big-truck operation still thriftier in '59 when you go *Ford*-ward. Send coupon for full information!



NEW Tractor Equipment Package provides complete trailer air brake and electrical connections, meets I.C.C. requirements.



NEW Ford Tilt Cab Tandems are available with three tandem-axle capacities: 28, 34, and 38,000 lb. Front axles to 15,000 lb.

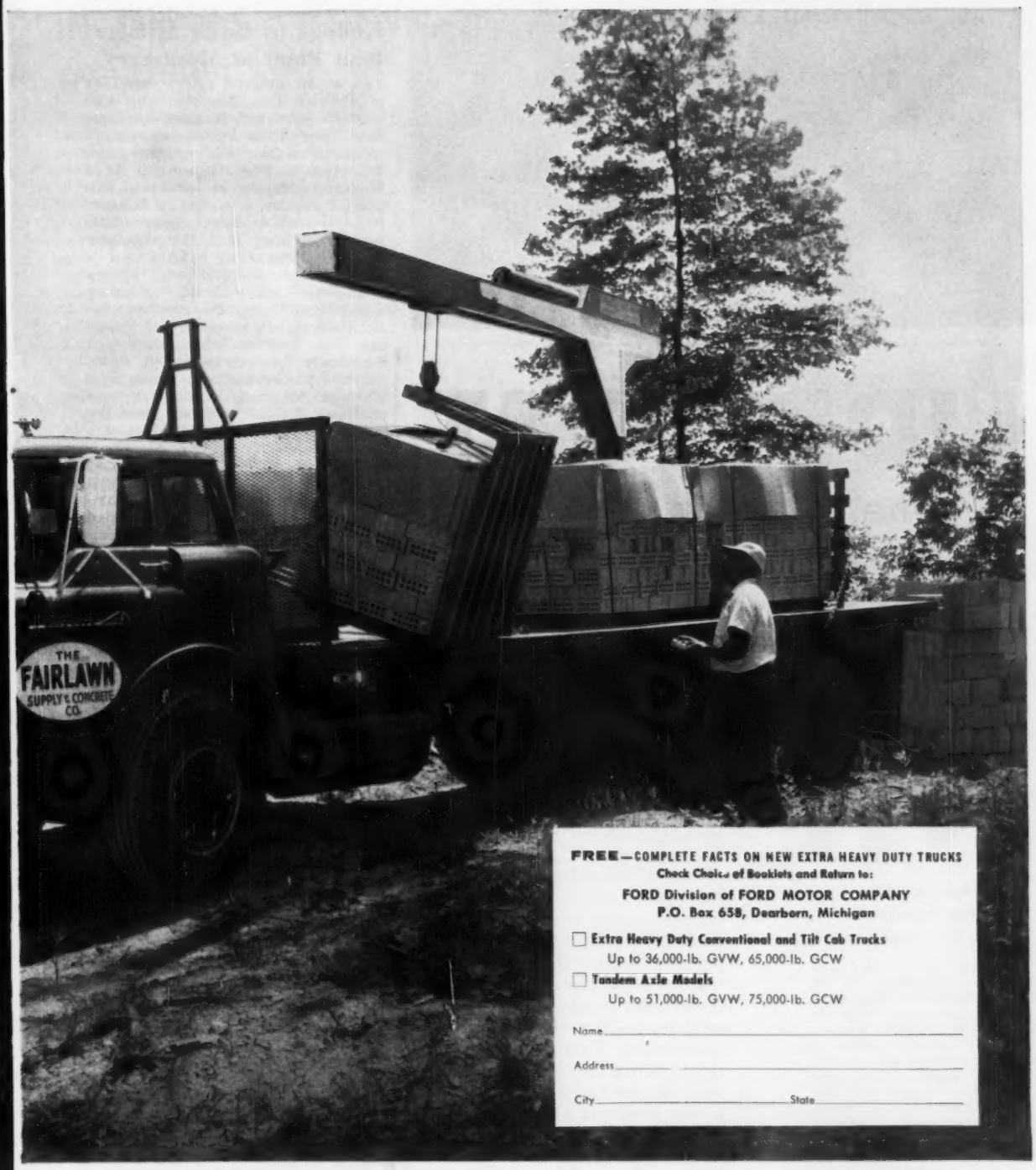


NEW Faster Axle Ratios team up with Super Duty V-8's for greater gas economy and reduced engine wear. For example, 5.43/7.39 to 1 available in 1100 Series.

NEW 2-Shoe Brake (parking) is standard for '59 on all Ford Extra Heavies. Has 50% greater stopping and holding power, requires 50% less effort to operate.

Tilt Cab Tandem Ford C-950 (above) has hydraulic loader with push-button remote control.

Go FORD-WARD for savings FORD TRUCKS



FREE—COMPLETE FACTS ON NEW EXTRA HEAVY DUTY TRUCKS
Check Choice of Booklets and Return to:
FORD Division of FORD MOTOR COMPANY
P.O. Box 658, Dearborn, Michigan

☐ Extra Heavy Duty Conventional and Tilt Cab Trucks
Up to 36,000-lb. GVW, 65,000-lb. GCW

☐ Tandem Axle Models
Up to 51,000-lb. GVW, 75,000-lb. GCW

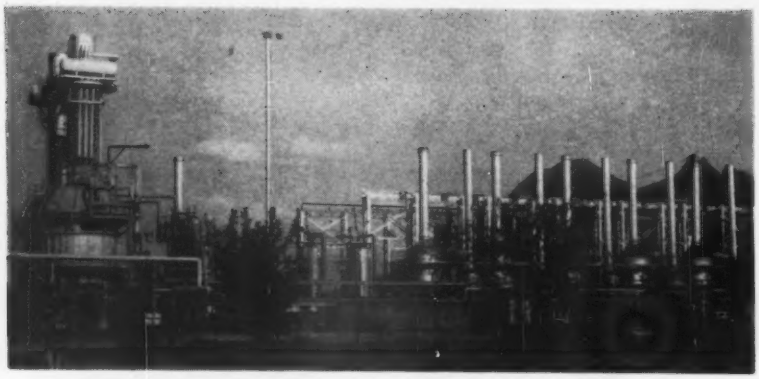
Name_____

Address_____

City_____ State_____

BRAND-NEW TILT CAB TANDEM FORDS for '59 combine the easier, more economical maintenance of tilts with high tandem-axle load capacities. Tilt design also permits higher front axle loads, longer body on given wheelbase. C-950 Tandem, above, operated by Fairlawn Supply and Concrete, Akron, has 15,000-lb. front axle, 34,000-lb. rear. Carries up to 6,500 brick, compared to 5,000 on a conventional tandem. Has 401-cu. in. V-8, 5-spd. main transmission, 3-spd. auxiliary, 201-in. wb. GCW (with pup trailer) 72,000 lb.

COST LESS ... *less to own ... less to run ... last longer, too!*



LIDDICOAT

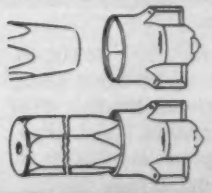
. . . the tungsten carbide bit that needs no resharpening

Illustrated is the popular Liddicoat uranium country bit made to withstand drilling in highly abrasive rock

The exclusive shallow long life inserts need no resharpening because they do not develop a reverse taper dullness . . . a condition that stops drilling in the conventional multi-use bit. The exclusive design of LIDDICOAT permits fast drilling far beyond the point where conventional multi-use carbide bits must be withdrawn from service for resharpening. Fast drilling continues during the entire bit usage without need of resharpening. Lower first cost — low cost per foot of hole drilled.

Taper socket —
No threads —
Fast, firm attachment

The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new short taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal.



For All Sizes of Drill Rod -- 7/8" to 1½" Forged for Toughness from Nickel Alloy Steel

WESTERN *Rock Bit Manufacturing Company*
552 West 7th South • Salt Lake City 1, Utah

Kellogg to Build Sponge Iron Plant at Monterrey

THE M. W. KELLOGG CO., a subsidiary of Pullman Inc., has been appointed exclusive sales and licensing agent for batch process for the production of sponge iron from iron ore using hydrocarbons by Fierro Esponja, S. A. of Monterrey, Mexico, an affiliate of Hojalata Y Lamina, S. A., one of Mexico's principal steel producers. Theoretically possible for many years, the production of sponge iron using hydrocarbons is now commercially practical. Hojalata Y Lamina, S. A. with the engineering assistance of Kellogg Co., developed this technique for the production of sponge iron from iron ore with natural gas. Technically and economically sound, this new process has been proven in a plant at Monterrey which has been producing 200-tpd of sponge iron for several months. (*see E&MJ;* December 1957).

Fierro Esponja, S. A. has just awarded a contract to Kellogg for a second plant which will produce 500-tpd sponge iron. This plant will embody several design improvements to increase the thermal efficiency of the process. The reducing gas, which is produced in a Kellogg high pressure steam reforming furnace, contains 85% hydrogen and carbon monoxide and is sulphur free. Five reforming furnaces will be installed to supply reducing gas for the new plant.

The actual reduction of the iron ore will be performed in four reactors each holding approximately 105 tons of ore. After the ore is reduced the remaining sponge iron will be removed from each reactor and conveyed into cars via a hopper and chute. The plant will be engineered so that the heat content of the reformed gas and the reduced ore is completely utilized. To achieve this unusually high thermal efficiency, after reduction the sponge iron is cooled which achieves another saving by eliminating the need for special equipment and procedures to handle metals at high temperatures. When ready for discharge from the reactors, the sponge iron either can be sent directly to electric furnace or can be stored for later shipment to steel plants.

DMEA Name Changed To OME

OFFICE OF MINERALS Exploration is the new name of the old Defense Minerals Exploration Administration, recently expanded and continued by Congressional legislation as part of Interior secretary Fred A. Seaton's program to step up government assistance to domestic miners.

The new lending agency's operations will differ from the old DMEA's in at least three respects. (1) applicants must provide evidence that funds cannot be obtained from commercial sources on reasonable terms; (2) interest is to be charged from the date Federal funds are disbursed to operators; and (3) Government participation in any contract may not exceed $250,000.

IN THE U.S.

CALIFORNIA

Homestake Mining Co. reported that earnings for first half of this year came to about the same level as first half 1957. Net income per share amounted to $1.12, compared with $1.13 for first half of 1957.

Income before Federal income taxes topped first half 1957—$2,980,390, compared with $2,925,757. But taxes were higher this year because a smaller amount of revenues was in the form of dividends, so net income amounted to $2,250,390—somewhat less than the $2,275,757 earned during 1957.

Bulk of the revenues were from sale of bullion from ore mined at the firm's gold properties in Lead, S. D. During first half of this year the firm milled 851,575 tons averaging $11.44 per ton and took in $9,740,157. During the same period last year less ore was milled, but it was higher grade—816,971 tons at $11.99 per ton—and the revenue amounted to $9,796,089.

The firm's Alice uranium lease in the Big Indian district of Utah emerged from the development stage in April and became an operating property, contributing $621,558 from the sale of uranium concentrates.

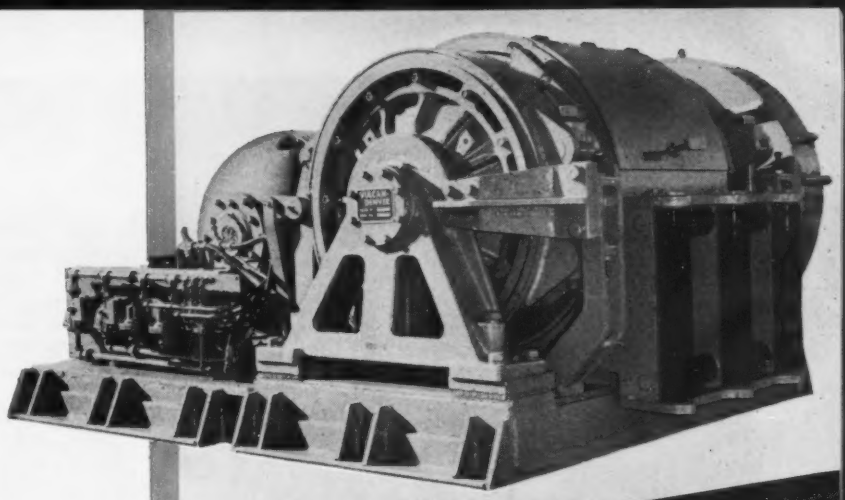
Subsidiaries that operate the La Sal and Little Beaver mines in the Big Indian District contributed $485,749 in dividends compared with $681,414 for first half 1957. Nearly all of this was from the La Sal mine, since Little Beaver production was being brought to an end.

Homestake - New Mexico Partners, whose uranium mill in the Ambrosia Lake district of New Mexico started production in March, contributed $166,-846 in income. Another Homestake venture in the same area—Homestake-Sapin—does not show up as a source of income, since its first shipment of concentrates was in September.

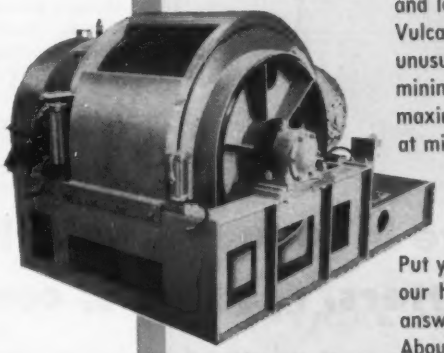
Francis Murphy of Oak Run has acquired the Evening Star Consolidated group of gold lode claims near the head of Gimlet Creek in the Greenhorn area of Baker County, Oregon. Murphy, in association with Richard E. Bixley, Carmel, plans to reopen some of the old workings and do some exploratory development.

John Bradley, San Francisco, has denied that any negotiations of any type have been carried on "at my level", regarding the merger of Bunker Hill Co. into and with American Smelting & Refining Co.

Mr. Bradley, president of Bunker Hill, said the story may have gained currency as a result of recent changes in smelting of ores in the West. (This was a reference to the deal whereby USSR&M Co. closed its smelter at Midvale, Utah, and started shipping concentrates to International Smelting & Refining Co.'s smelter at Tooele. IS&R (an Anaconda affiliate) in turn is sending its ore to the U.S. mill at Midvale. International is closing its Tooele mill.)

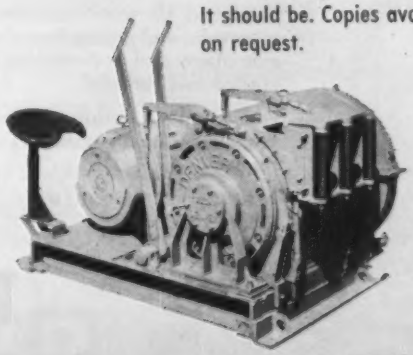


SPECIAL SLUSHERS SOLVE MORE PROBLEMS



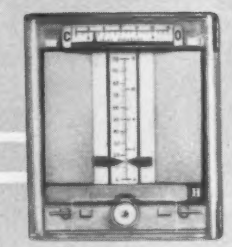
Customers who come to Vulcan-Denver for special slushers like these do so knowing there are standard Vulcan units available with comparable drives, capacities and long service life. In each case a Vulcan-Denver special solves some unusual problem of physical layout or mining conditions—always with maximum use of standard parts and at minimum expense and delay.

Put your unusual slusher problems in our hands for a competent, economical answer—no obligation of course. About standard Vulcan-Denver slushers, is our Catalog DB5506 in your files? It should be. Copies available on request.

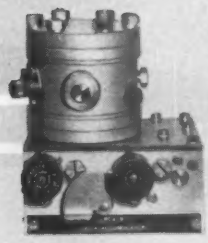


VULCAN IRON WORKS CO.
2960 SOUTH FOX
ENGLEWOOD, COLORADO

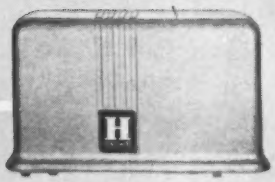
VULCAN DENVER 1891



***TEL-O-SET* RECEIVERS** can be used with any pneumatic force-balance controller. Recorder and indicator chassis are interchangeable: to make a change, or overhaul the instrument without process downtime, just pull out one chassis and slide in another. All adjustments and normal servicing can be handled from front of panel.



***TEL-O-SET* CONTROLLERS** provide proportional-plus-reset control. Quick-connect switch permits removal of controller while process remains on manual control from front of panel. One basic model controls any variable. Unitized construction of all components simplifies maintenance, makes reassembly foolproof. Rate action easily added.



***TEL-O-SET* TRANSMITTERS** are as accurate at small spans of 20 psi and 50°F as at wide spans of 150 psi and 400°F. Range is fully adjustable without adding or changing parts; no need to stock an assortment of thermal systems or spring assemblies. High-speed response to process changes permits control within close tolerances. Can be mounted at point of measurement, indoors or outdoors.

You save in <u>many</u> ways with TEL-O-SET transmitters, receivers, controllers

. . . today's most advanced miniature pneumatic instruments

Designed to work together as a team, *Tel-O-Set* transmitters, receivers, and controllers also can be used to advantage with other miniature and conventional size instruments. They're easily installed and serviced.

Get complete details on *Tel-O-Set* instruments from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL First in Control

California (*Continued*)

Pacific Industries, Inc. whose subsidiaries include a uranium mining firm, has obtained a $2-million loan that will be used to re-finance the bulk of the company's current indebtedness.

Said P.I.I. president Henry L. McIntyre: "We are now in a position to pursue actively our plans for expansion."

The company recently announced plans for further exploration work by its subsidiary, Flanders Mining Co., at a uranium property in the Gateway area of Beaver Mesa, 65 miles southwest of Grand Junction, Colo.

U.S. Borax & Chemical Corp.'s Pacific Coast Borax Co. Div. recently announced plans to increase its boric acid production at Wilmington, Calif.

According to J. F. Corkill, vice president and general manager of the division, the increase in production is essential to fulfill the increased demand for boric acid in many industries and to supply imminent requirements of the boron fuel manufacturers.

COLORADO

Perlite to be mined at the former Great Lakes Carbon claims near Rosita and crushed at the plant near Silver Cliff, will be used for a new industry at Florence. The new industry is known as Persolite Products Inc. and has been operating in Denver for the last 11 yr under the ownership and management of Herman Freudenberg.

The new industry will operate at the site of the former Great Lakes Carbon Corp. plant in Florence. Persolite Products Inc. leased Great Lakes mining claims in Custer County and purchased the plant at Florence from the corporation. An office will be built at the plant.

Pacific Industries, Inc., announced recently that it had undertaken the active mining of uranium ore in the Gateway area on Beaver Mesa, located 65 miles southwest of Grand Junction.

Up to now Pacific Industries, through its Flanders Mining Co. subsidiary, has operated as owner and lessor of its uranium interests, with the mining being done by lessees under royalty arrangements, according to Henry L. McIntyre, Pacific Industries' president.

"Our decision to mine the Gateway property ourselves is the result of an evaluation conducted during the past eight months of all our Flanders Mining interests," McIntyre declared. "Certain claims which did not indicate profitable ore bodies have been relinquished and written off the books. Other claims are still under development by lessees. However, we have now acquired the full mining rights to the most promising properties."

Work has begun and is progressing according to schedule on opening mining operations on the Williams property near Rosita. The S.N.N. Mining Co. Inc., with headquarters in Cheyenne, Wyo., is doing the development work.

THE TOP OF ITS CLASS

T-16 OPTICAL TRANSIT

In any comparison of optical and mechanical precision, features and versatility, three characteristics of this repeating transit become immediately evident:

The Wild T-16 is faster, more accurate, and much easier to work with than any other instrument in its price class.

This is the consensus of engineers and surveyors in mining, highway and land surveying functions throughout the world.

Your own evaluation, cordially invited, will quickly prove these facts. Write for the WILD Bulletin T-16.

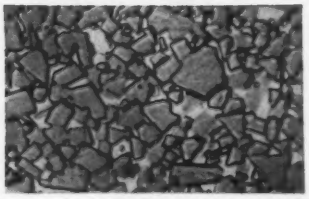
WILD HEERBRUGG

Full Factory Services

INSTRUMENTS, INC.

MAIN AT COVERT STREET, PORT WASHINGTON, NEW YORK • PORT WASHINGTON 7-4843

Longer bit life— with *new* Sandvik Coromant Bits



Sandvik Coromant Tungsten Carbide (Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities —therefore stronger, longer-lived.

Low quality Tungsten Carbide (Microphoto) Black marks are contaminations caused by deficient production control. They weaken the carbide, reduce its working life.

NEXT time you buy bits, specify Sandvik Coromant because they give more footage per bit, lower drilling costs. Here's why:

1 Only first-quality tungsten carbide is used —as shown in the microphotos above. This means less wear, longer life and a better job.

2 The bodies are precision-made of high quality alloy steel—tough enough to take the strain throughout the extra-long bit life.

3 The bigger Sandvik Coromant bits are all of X-design, which prevents rifling. No wonder Sandvik Coromant inserts are the most widely used in the world, drilling more than one billion feet every year.

SANDVIK COROMANT bits are supplied through Atlas Copco, the world's largest manufacturer of rock drills, who also supply Sandvik Coromant integral steels — the most widely used in the world — and Sandvik Coromant extension steel equipment.

Sandvik Coromant Detachable Bits are Available in the following Thread Sizes and Bit Diameters

Type	Thread	Available Diameters, in Inches														
		1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2¾	3	3½	4	4½	5
SHOULDER	F	x	x														
	113	x															
	H		x	x	x	x											
	115		x	x													
	D					x	x	x	x	x	x	x	x				
	K												x	x	x	x	
BOTTOM	1" Rope			x	x	x											
	200			x	x	x											
	1¼" Rope					x	x	x	x		x		x				
	400						x		x		x						
	1½" Rope										x	x	x	x	x		
	600										x	x	x	x			
	700												x	x			
	J. 7.5														x	x	
	2" Rope													x	x	x	x

Write or phone today for further details to either of the addresses below:

610 Industrial Avenue
Paramus, New Jersey
COlfax 1-6800

Atlas Copco

930 Brittan Avenue
San Carlos, California
LYtell 1-0375

Colorado (*Continued*)

Bill Specht, president of S.N.N. and Ace McFall of Westcliffe are working on a tunnel being driven to go into the Pioneer and other shafts on the Williams leases.

The Pioneer and other workings in the Rosita vicinity produced considerable silver ore prior to the silver panic of around 1893.

Gold production in the Cripple Creek District is slightly behind 1957 production for the first six months of this year. Production, through June 1958, totaled $781,904. For the same period last year, production was $870,753.

For the first six months of 1958, a total of 39,833 tons of mine ore, valued at $702,951, was received at the Carlton mill. For the same period, 13,962 tons of dump ore, valued at $78,953 were received. Gold bricks number 409 and 410 valued at $67,000, have just been shipped to the Denver mint from the Carlton mill.

During 1957, 43,625 tons of mine ore were shipped to the mill for a total value of $785,136. The dumps accounted for 17,317 tons valued at $85,617.

Production at the Cresson mine at Cripple Creek has slowed down to put in chutes on the 2000 level and to do some clean-up work. The company is drifting on 1900, getting a few pay samples which look promising.

During the month of June, a total of 1,834 tons of muck was shipped to the mill with a net value of $18,144. Lessors accounted for 1,552 tons valued at $11,801, with the company shipping 282 tons worth $6,342. Average value of the muck was $9.89 per ton.

For the first six months of the year, the Cresson has produced $119,016, net value in ore. Average value for the year thus far is $6.82 per ton.

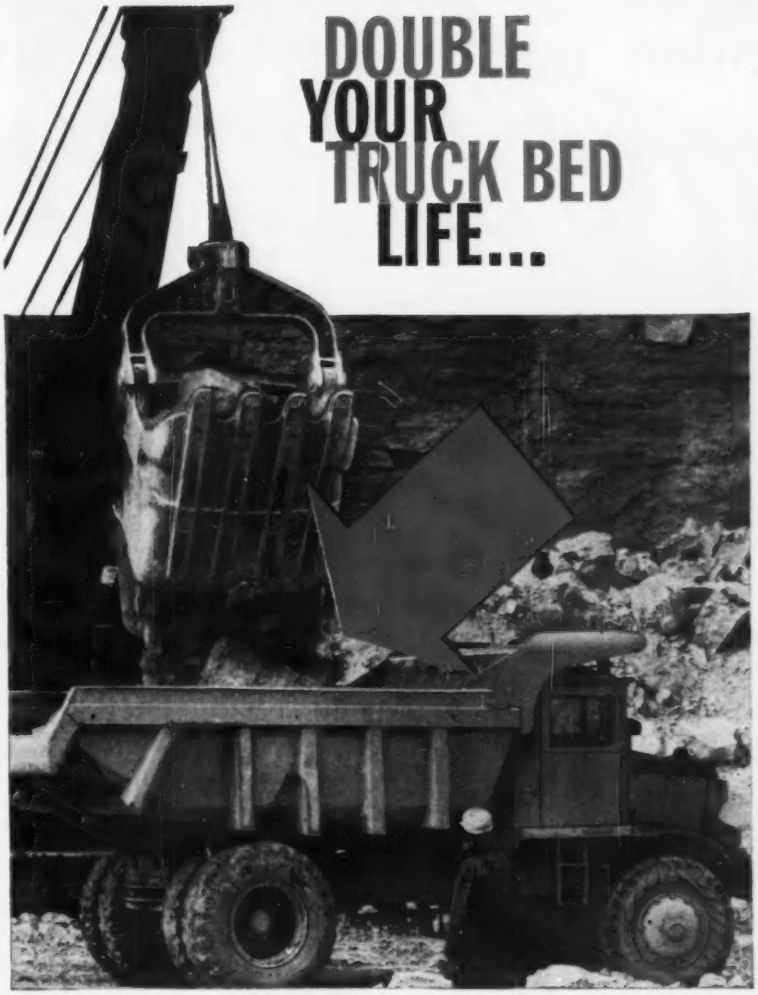
A new ore bin, with a vibrating screen, is being built adjacent to the head frame of the Ajax mine of Golden Cycle at Cripple Creek. This improvement will enable the company to dump ore directly from the head frame when it is hoisted. Tonnage remains good and the values of the Ajax ore are holding up.

Polkinghorn and Kouba, leasing on the 3000 level, got a mine assay of 4.20 oz Au to the ton on a shipment they sent to the mill recently.

Officials report that a record volume of silver poured into the Denver Mint in July. The 1,124,661 ounces worth $1,017,734 received during the month topped the previous mark of 1,082,000 oz taken in last February. The continuing low world price of silver stimulates the heavy movement of the metal to the U.S. Government.

Silver receipts here are largely from Kennecott Copper Corp. and American Smelting & Refining Co. operations in Utah.

"The space age is here and our industry is totally unprepared," William Dansby told the executive committee of the Beryllium Mining Assoc. Mr. Dansby, who is president of the association, in



DOUBLE YOUR TRUCK BED LIFE...

WITH AMSCO®

manganese steel plate lining

Amsco manganese steel plate resists tremendous shock. Turns a tough hide to the clawing action of abrasive materials. Its nonmagnetic properties make it ideal for moving in under the electromagnet.

The company, whose truck is pictured above, lines all new truck beds. Under severe test of a 3½ minute loading cycle, they found that truck-bed life is extended from two to five full seasons.

Amsco manganese steel plate is easy to weld, easy to cut with an oxyacetylene torch.

For additional information, write Amsco Division, Chicago Heights, Ill. Or call your local Amsco distributor.

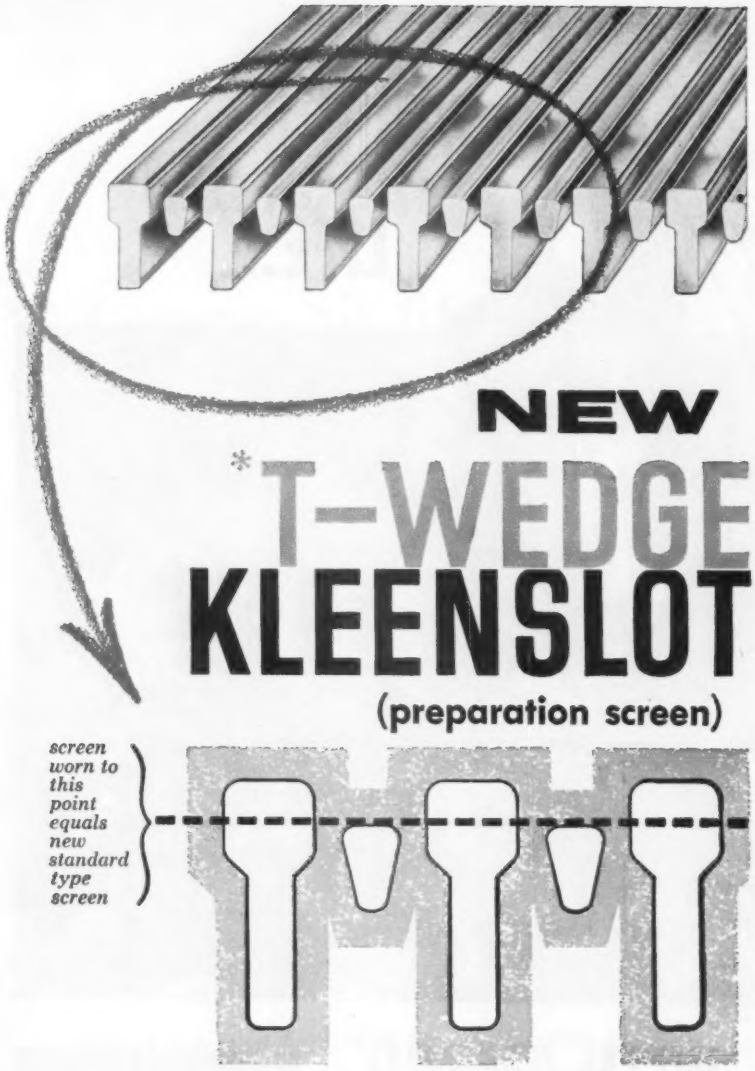
Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS, JOLIETTE, QUEBEC



NEW

*T-WEDGE

KLEENSLOT

(preparation screen)

"T" and "WEDGE" wire combine to create the ultimate in...

GUARD BAR DESIGN – high "T" profile wire between every wedge shaped wire performs as guard bar *and* screen

GUARD BAR ECONOMY – new design effects added screening surface, small screen efficiency with large screen life

with *I.F.A. *independent flexing action for non-blinding, non-clogging performance*

new T-WEDGE screen is especially adaptable for flumes or vibrator applications—can be easily interchanged with other types of Kleenslot screens without mechanical changes—abrasion resistant stainless steel

FOR ADDITIONAL INFORMATION . . . write

WEDGE-WIRE CORPORATION
Wellington, Ohio

*patent applied for

Colorado (*Continued*)

reporting on his recent Eastern conferences with industrial and government nuclear and metallurgical experts, requested the committee to call for a special meeting of the full membership.

A stepped-up search for domestic sources of beryl, coupled with mining and metallurgical studies aimed at supplying fast growing needs in the missile, aircraft, and atomic-energy fields, are major features of the Bureau of Mines research program for this mineral during fiscal year 1959 that began July 1, the Bureau announced.

The famous old Strong Mine at Cripple Creek has shut down, according to John Deerksen, president of Front Range Mines, Inc. Deerksen said the drastic action was necessary "because the cost of materials, labor and supplies cannot be offset by the present value of ore." For several years, the Strong shipped high-grade ore that averaged from 2 to 3 oz Au per ton.

The Strong Group, since its discovery, has produced more than $30-million in gold. In late years, under Mr. Deerksen's management, it has produced a gross of more than $2.5-million.

The Golden Cycle Corp. reports uranium ore production from its Edgemont, South Dakota, properties from July 1, 1957 to June 30, 1958, was 29,064 tons with a total gross value of $435,449 and an average per ton value of $14.98.

"Provided a mill contract is granted for the Front Range area to its proposed uranium mill at Cripple Creek, there will be a large increase in uranium prospecting and mining in this area. Our engineers are now examining several properties, and we hope to secure mining contracts on some of the better ones which will insure a steady flow of uranium ore to the mill. To date the average grade of ores ranges from 0.20 to 0.25% U_3O_8," the company reports.

IDAHO

Phillips Petroleum Co. has started production of uranium ore from the Little Bill property, also known as the Cold Creek claims, in the Stanley area of Custer County. An initial shipment of between 50 and 60 tons of ore was trucked out early in August from the remote mine in the mountains east of Stanley and shipped by rail from Ketchum to a processing plant. The big oil company took over development of the claims early this year under an agreement with owners Bill Brooks, Jules Kauffman and Melvin Peterson, all of Hailey. Its first project was the construction of several miles of access road to the site where extensive drilling has indicated a rich ore deposit which can be mined by open-pit methods.

Black Bear Silver-Lead Mines Co., 50%-owned affiliate of Metropolitan Mines Corp., has opened new lead-silver ore of commercial width and grade at the old Black Bear property on Canyon

KUE-KEN® crushes more rock per hour, every hour . . . automatic flywheel release saves downtime, costly repairs

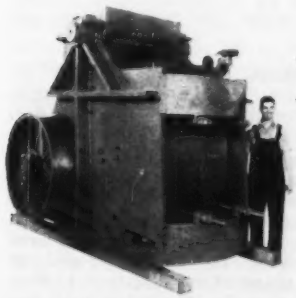
Here is a table of tons per hour that will pass through crusher with jaws set at dimensions shown when measured in the closed position.

Kue-Ken crusher size	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	5"	6"	Horsepower range
24" x 12"	22	26	32	36	43	50	56					15 to 30
30" x 12"	32	35	38	42	55	70	76	85	110			20 to 30
36" x 10"	38	47	57	67	80	91	105					25 to 40
36" x 20"					70	82	90	115	135	160		30 to 50
42" x 25"					90	120	150	165	180	215	250	40 to 60

Table is based on crushing average hard dry quartz or similar rock weighing at least 100 lbs. per cubic foot when crushed. 32 sizes available from 12" x 5" to 48" x 42".

Tramp iron cannot damage Kue-Ken or cause long, costly interruptions to crushing schedules. With Kue-Ken, an automatic control releases the flywheel and permits it to run free without ratcheting. On correction of the cause, the flywheel can be quickly reset and crusher put back into operation promptly. Control can be set to stop the motor automatically on release of flywheel or to sound an alarm. Kue-Ken gives the lowest cost per ton crushing. It has a built-in lubrication system with thorough lubrication that permits more crushing strokes per minute for greater crushing capacity. Horsepower requirements are less. Regardless of your crushing requirements, see in the above chart how a smaller, less costly Kue-Ken can provide the capacity you require.

Kue-Ken flywheel with automatic release



Write for catalog

KUE-KEN® CRUSHERS

STRAUB MFG. CO., INC., 8384 BALDWIN • OAKLAND, CAL.

"CRUSHING WITHOUT RUBBING"

Jaw Crushers Gyratory Crushers Overhead Eccentric Crushers Revolving Screens Classifiers Feeders Rib Cone Ball Mills Concentrating Tables Vibrating Screens

Pennsylvania Crusher Division, Exclusive Licensed Eastern Manufacturer and Distributor, 323 S. Matlack St., West Chester, Penn.

Armstrong Whitworth (Metal Industries) Ltd., Authorized Licensed Manufacturer and Distributor, Close Works, Gateshead-upon-Tyne 8, England

no more knuckle-busting . . .

New RIDGID No. 450

Portable Tristand Chain Vise

Capacity, ⅛" to 5"
Weight, 42½ Lbs.

has Large, Easy-to-Operate

Top Screw Handle right up on top

Here's a real time saver. Not only do you get a complete workbench that's truly portable, but now you get a chain vise that's extra easy and fast to operate. Handle is right up on top where it's always handy. Handle and tightening nut are anchored to vise base . . . can't pull out.

Vise base, that overhangs front legs for clear tool swing, has hanger slots for tools, 3-size pipe bender, rear pipe rest and adjustable ceiling brace screw. Folding legs and integral tray set up easily and lock in position for rigid work base. Snap chain holds folded legs closed for easy carrying . . . no loose parts. Rubber grommets in tristand feet prevent creeping. See and try this more-for-your-money RIDGID Top Screw Chain Vise at your Supply House!

New RIDGID Bench Chain Vises
have same Extra-Efficient Top-Screw Adjustment

5 Sizes for ⅛" to 8" Pipe, Conduit or Rod

The Ridge Tool Company, Elyria, Ohio, U.S.A.

Idaho *(Continued)*

Creek northeast of Wallace. The mineralized zone is about 8 ft wide at the point of initial contact, with about 5 ft of good-grade milling ore containing several seams of high-grade. An east development drift along the structure is now being driven. Present plans are to extend the drift a minimum of at least 50 ft if the values persist before starting a raise to determine if the ore improves on its upward projection as other ore bodies in the mine have done.

American Smelting and Refining Co. has started development of a new 4,000-ft level on the big silver vein in the Galena Mine on Lake Gulch just west of Wallace. About 70 ft of drifting on the structure was completed after the 4,000 horizon was reached by the new inclined shaft which extends from the 3,400 level, and it has exposed a strong vein structure with good mineralization. Drifting was then temporarily suspended while shaft crews put in a 50-ft sump below the new level. The rich silver ore shoot is now open over a vertical distance of more than 1,600 ft and over a maximum horizontal distance of about 900 ft. Exploration of an extensive zone of lead-silver mineralization a short distance south of the main vertical shaft is continuing and an extensive diamond drilling program started early this year is still in progress.

Federal Uranium Corp. has started putting down a new 1000 ft, 3-compartment shaft at the Conjecture silver mine in the Bayview District of Bonner County on the strength of the two substantial ore shoots disclosed by development work on the 700 ft level from the old inclined shaft. An additional factor in the decision to sink the new shaft was the disclosure by diamond drilling that the St. Regis formation, a more favorable host rock for ore deposition, replaces the Wallace formation about 150 ft below the 700 level. Federal Uranium is exploring and developing the property under an operating agreement with Conjecture Mines Inc.

Clearwater Mines Inc. is now rehabilitating the mine workings and surface plant at its claims on Niagara Creek in southeastern Shoshone County in preparation for resuming exploration work. First project will be some diamond drilling to trace indicated extensions of the copper-silver-gold orebody opened at the 2100 ft point in the adit tunnel.

Rare Metals Corp. of America has launched an extensive search for metals and industrial minerals along the Bear Creek Valley, Valley County.

"With the advent of favorable weather, the corporation's crews moved in on the large acreage of placer ground. "Ore samples indicate the presence of euxenite, columbium and tantalum minerals, monazite, zircon and ilmenite," said an interim report of the affiliate of El Paso Natural Gas Co. The report said that systematic sampling and evaluation of the properties are underway.

Idaho *(Continued)*

An 11-mile black-top "private road" has been cleared by courts for construction by Monsanto Chemical Corp. from its elemental phosphorus reduction center at Soda Springs, Idaho to its open cut phosphate rock mine on the Black Foot River.

Monsanto was successful in clearing the way for building the off-highway road through purchase and through court-backed establishment of commissions to establish a fair value for land of those individuals who refused to grant right-of-way.

The construction of such roads is regarded nationally as a means of permitting use of huge earth and ore moving trucks over extended distances. Such trucks are not permitted to travel on regular highways utilized by the public.

Fifth district court (state) of Idaho in clearing way for start of construction appointed a commission to condemn and set value on properties of Thomas Cellan whose properties were in the path of the road.

R. R. Rumer, Monsanto manager at Soda Springs, said that the chemical firm had previously settled privately with 18 other property owners along right of way of the private road and that it had completed commission-type condemnation of properties of a remaining owner.

The road will permit the use of 100-ton ore haulage units by Morrison-Knudsen Construction Co., open pit mining contractors for Monsanto.

"Savings on construction of this road, permitting volume movement of ore, will increase the amount of overburden on a cost-factor basis, which may be removed at the mine," Rumer said.

Regular production of uranium ore has been started by Silver Buckle Mining Co., at the Spokane Indian reservation property in Stevens County, Wash., which the company acquired last May from Northwest Uranium Mines Inc., a Silver Buckle affiliate.

Stripping of several hundred thousand tons of overburden from the large, low-grade ore deposit was completed during July and August and between 7,000 and 8,000 tons of ore were stockpiled from the first bench exposed. This ore is now being trucked to Dawn Mining Co.'s processing plant at nearby Ford, Wash., under a custom milling contract, and stripping of another area which will supply sufficient ore for at least a year's production is now in progress. First net proceeds from production will go to reimburse Silver Buckle for its mine development outlay. After this has been repaid, Northwest Uranium will receive 87½% of the proceeds until the purchase price of $2.5-million has been paid.

Special meetings of the stockholders of Hecla Mining Co. and its subsidiary, Polaris Mining Co., will be held in October to consider and vote upon a proposal to merge Polaris into the parent firm on the basis of a stock conversion ratio of six shares of Polaris for one share of Hecla.

The merger plan has been unanimously approved by directors of both

CHRISTENSEN DIAMONDS *mean greater core recovery!*

UNCONSOLIDATED FORMATIONS NOW CORED SUCCESSFULLY!

With newly designed Christensen soft formation barrel and long nose pilot bit

This newly designed diamond coring equipment overcomes the problem of poor core recovery in soft, unconsolidated mineralized formations. By coring ahead of the circulating fluid, the pilot bit, in conjunction with the soft formation barrel, protects the core from moving fluid thereby preventing fluid erosion.

In a recent uranium operation at McKinley County, New Mexico, this equipment was used successfully in the Westwater formation, a soft, unconsolidated sandstone, where previously, high core recovery was very difficult, and many times impossible. The operator reports that this equipment recovered *over twice the core* (up to 98%) that had previously been recovered by conventional equipment. In addition to New Mexico, superior results have been obtained in soft iron ore formations in Southern Utah and Northern Minnesota with a slightly smaller barrel and bit. Excellent results have also been obtained in the Wind River formation of the Gas Hills area in Wyoming.

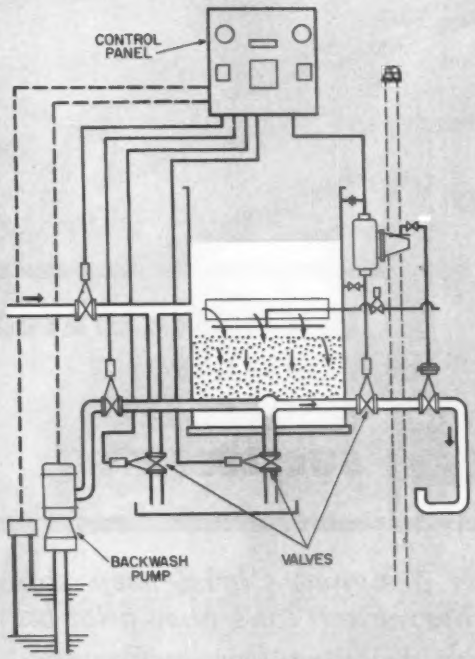
If your problem is obtaining "good" core in soft, unconsolidated formations contact . . .

CHRISTENSEN DIAMOND PRODUCTS *Less cost per foot*

1937 SOUTH 2nd WEST • P. O. BOX 387 • SALT LAKE CITY, UTAH

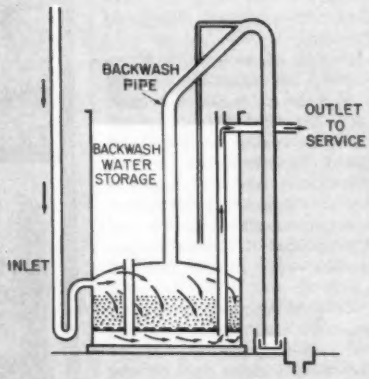
CONVENTIONAL gravity filter and hydraulic controls for automatic operation. Approximate installed cost of a unit that will filter 500,000 gallons per day:

$21,700.00



NEW PERMUTIT VALVELESS Gravity Filter. Completely automatic operation. Approximate installed cost of a 500,000 gpd unit:

$11,900.00



HOW IT WORKS: As dirt collects on the sand, increased head pressure slowly raises the water level in the large backwash pipe. See diagram. When it spills into the downward section of the pipe, it starts a siphon (backwash) flow that draws water down from the Storage area and up through the sand, "floating" dirt off to waste. When backwash water is gone, air enters the small tube and stops the siphon. Flow through the sand reverses and the first filtered water (rinse water) goes to Storage area until full. All flow then runs to Service.

New Valveless Water Filter Saves $$ for Industries, Cities, Electric Companies

• Big water users like city water departments, steam stations, refineries, chemical plants and paper mills can substantially reduce the cost of their water-conditioning equipment and its operation and maintenance . . . by adopting a new automatic Valveless Filter developed by engineers of the Permutit Company (N. Y.).

The simplified design makes ingenious use of the siphon and other hydraulic principles to replace expensive valves, flow controllers, pumps and hydraulic or pneumatic control systems. The design also prevents wasteful, excessive use of water for backwashing or rinsing. Tanks are shipped set-up to reduce installation costs. The absence of moving parts virtually eliminates maintenance costs.

The Valveless Filter produces uniform, high-quality water. It cannot be "forced." Backwashing or rinsing cannot be too little or too late . . . or accidentally run to Service. And the filter cannot develop common troubles like "cracked" or "upset" beds, "channeling" or "mudballs."

Single Valveless Filters or multiple units for any volume requirement are available. Present installations include units for industrial plants treating water for both process and drinking.

Send for free descriptive bulletin. Address: The Permutit Company, Dept. EM-10, 50 West 44th St., New York 36, N. Y. or The Permutit Company of Canada, Ltd., Toronto 1, Ontario.

PERMUTIT®
rhymes with "compute it"
a division of PFAUDLER PERMUTIT INC.
Water Conditioning
Ion Exchange • Industrial Waste Treatment

How to prepare now

for Profitable Production

in the Expanding '60s!

PLAN '59

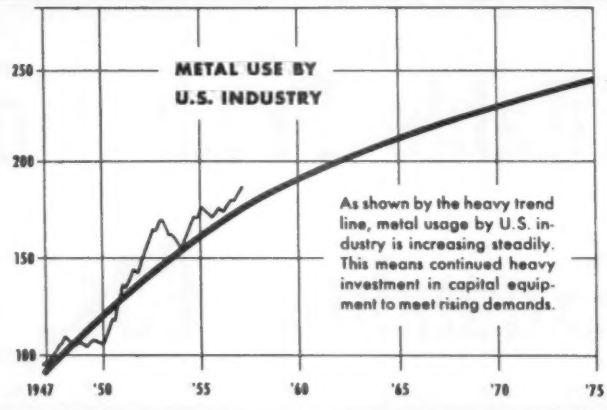
Modernize now
for growth and profits

A SPECIAL REPORT

For All Forward-Looking Mining Officials

COMING IN NOVEMBER

PLAN '59



U.S. Consumptian, Metals and Non-Metallics

	(thousands of short tons) 1957 Consumption	1975 Consumption*	Projected % Increase, 1957-75
Copper	1,350	2,500	85.11
Lead	1,135	1,950	71.87
Zinc	936	1,600	70.94
Aluminum	1,940	4,500	131.91
Crude Steel**	113	150	32.75
Fluorspar	695	1,060	60.83
Sulphur***	5,550	10,100	81.95

*As projected in the Paley Report
**Millions of short tons
***Long tons

Vast Growth Opportunities Ahead for Forward-Looking Mining Management

The outlook for mining, all authorities agree, is one of continuous, long-range growth to meet expanding demands for metals and nonmetallics.

Current oversupply and soft prices, temporary conditions tied to the Nation's economic climate, do not obscure the steady upward trend in the consumption of metals, increasing demand and new applications for both military and civilian products, the effects of increasing industrialization and swelling population throughout the world.

The Paley Report, for example – an authoritative government study – predicted by 1975 an 85% increase in copper consumption over 1957, a 33% boost in steel, 132% for aluminum, 71% and 72% for zinc and lead, respectively. McGraw-Hill economists currently predict a 55% gain in U.S. need for steel between 1957 and 1975; a 300% boost in aluminum use; at least a 40% growth in consumption of copper, lead and zinc.

This bright outlook is realistic, the present slack-off not withstanding. It's a growth picture firmly established on the U.S. and world economic development anticipated over the next 20 years.

Right now, the United States is entering a new period of economic growth as it leaves behind the recession of 1958. Numerous economic signposts point to the resumption this fall of continued economic progress – the normal way of life for the U.S. economy.

Actually, our economy can only go up! For one thing, during the next 10 years American business must provide the goods and services required for a population that will increase by 32 million people. By just 1965, our gross national product may expand by $160 billion, the economists figure.

In other sections of the world, as well, growing population and the struggle for better standards of living are continually expanding the mining industry's horizons for the future.

GUARANTEE FOR THE FUTURE:

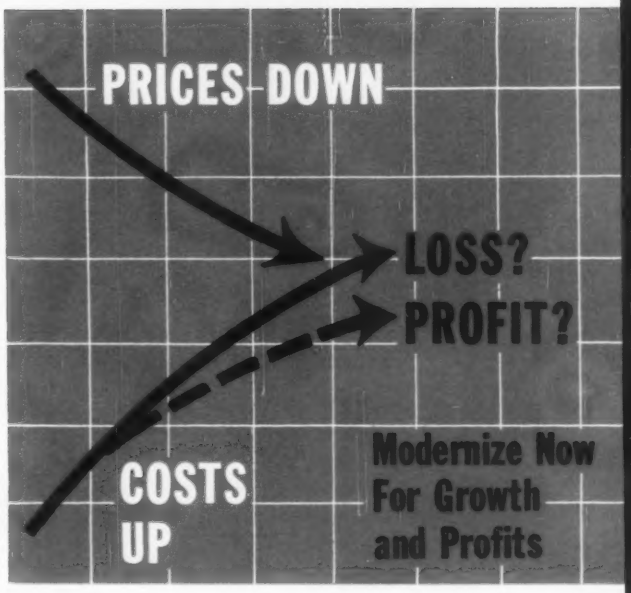
Low-Cost, Modern Production Facilities

Are you — and your company — ready to meet the demands and the opportunities of the '60s?

Mining's expansion potentials of the next decade mean no automatic bonanza for individual companies —no complacent, "me-too" coasting for management men who want their business to flourish and grow at a profit.

Competition between metals, declining ore grades, the expense of finding new deposits, rising production costs of all kinds, more complex technology, sensitive market prices, the short-term vagrancies of customer demand — These are today's continuing problems that will only be compounded as the industry grows.

Management is the answer — smart, alert, forward-looking management providing modern, low-cost production facilities needed to profitably combat rising costs.



For many mines, a change in metal prices, higher operating costs, bring shut-down, financial ruin or profitless marking time.

For others that survive, modernization of mine and plant facilities, more efficient, lower-cost machinery and operating methods, have meant continued profitable growth.

PLAN '59

E&MJ's SPECIAL NOVEMBER REPORT

How Management Plans For Profitable Growth in the '60s!

"How to Modernize" for the growth opportunities of the next decade is the theme of the Special Report appearing in November ENGINEERING AND MINING JOURNAL.

Where are the opportunities . . . what can you do . . . how do you start . . . these are the key guides to progress through modernization E&MJ's November report will offer readers. Analysis of significant operating factors, plus actual case histories, will cover key areas where mine and plant modernization pays most heavily, on such subjects as:

Equipment Procurement and Replacement

Production Planning

Plant Layout and Design

Materials Handling

Automatic Controls

Essentially, E&MJ's Modernization Report will be a study of management today . . . what sucessful, far-sighted companies are doing right now to prepare for profitable expansion in the next 10 years . . . a series of idea-stimulating guides against which you can check your own plans and potentials.

PLAN '59

NOVEMBER E&MJ

"HOW TO MODERNIZE"

Here are the 28 key elements of "scientific management"... the important areas of operating methods and equipment where applied modernization can quickly increase profits for mines, mills and smelters. E&MJ's Special November Report will provide yardsticks every executive, operating and supervisory official can check against his own job responsibilities and procedures.

Methods

Operation analysis and improvement
Work simplification
Materials handling
Technological intelligence
Production planning
Clerical procedures
Safety
Communication Systems
Standardization

Work measurement

Labor performance
Cost performance
Production performance

Wage payment

Wage incentives
Job evaluation
Merit rating
Wage and salary administration

Controls

Production control
Inventory control
Quality control
Budgetary and cost control
Management controls

Plant facilities and design

Plant layouts
Equipment procurement and replacement
Equipment and tool design

Others

Suggestion systems
Operations research
Preparation of operating and maintenance manuals
Organization planning

E&MJ SINCE 1866 THE LEADING INFORMATION SOURCE FOR WORLD-WIDE MINING

This "Plan '59" Report is but one special project among the continuing flow of mine and plant descriptions, special studies, technical articles, economic analyses and monthly departments you'll find in ENGINEERING AND MINING JOURNAL month after month.

E&MJ's editorial pages are planned to supply the informational needs of all executive, engineering and operating management concerned with any phase of mining and extractive processing of minerals. As mining's recognized authority, E&MJ is read, used and relied on regularly by more than 20,500 paid subscribers in every part of the world.

To keep ahead of the industry's newsworthy developments, take a tip from mining's top operating men ... turn to E&MJ every month.

ABC ABP A McGRAW-HILL PUBLICATION • 330 WEST 42nd ST., NEW YORK 36, N. Y.

Idaho *(Continued)*

companies and requires a two-thirds majority vote of stockholders for ratification, under the laws of the states under which the companies are incorporated. However, the merger plan specifies that the decision in the case of Polaris will be left to minority stockholders—that is, those owning the shares not held by Hecla. Hecla's 55.06% stock interest in Polaris will be voted in accordance with the majority vote of the minority shares represented at the meeting.

The consolidation has been proposed because it will result in a financially-stronger corporation, with combined net working capital of nearly $6-million, and it will eliminate intercompany management and accounting problems. The 6-for-1 conversion ratio was arrived at after considering a number of factors, including relative working capital of each firm, physical plant and equipment, known ore reserves, prospects for new ore discoveries and present and estimated future earnings. During the past three years, Hecla's average annual earnings have been more than six times greater than those of Polaris.

Capital-Seaboard Co., Farmington, N. M. has been granted a DMEA loan of $62,500 to prospect cobalt ores in Lemhi County.

The prospect is on claims near the Blackbird mine of the Calera Mining Co., subsidiary of Howe Sound Co.

Capital-Seaboard has 15 claims covering some 300 acres in the Lemhi district. U.S. Government puts up 62% of the funds in a cobalt grant.

MAINE

Test drilling operations in Knox, Waldo, and Lincoln Counties have recently been started by Roland F. Beers, Inc., Troy, N.Y., on several areas that show attractive nickel-cobalt prospects.

According to John R. Rand, state geologist, Department of Economic Development, the company's preliminary findings have developed sufficient evidence to warrant approval of more detailed exploration operations from the DMEA, which has appropriated $71,000 to assist in this work.

MICHIGAN

Attorney General, Stewart Honeck, of Wisconsin, said at Madison in August that conservation interests would not be affected by the Ashland Mining Co.'s proposed taconite mining operations near Butternut, Wis. He proposed to Governor Vernon W. Thomson that discussions be held with the mining company to determine whether present water use laws would permit the company to obtain sufficient water for its operations or if new legislation would be required. The contemplated plant would cost between $35 and $50-million and employ about 400 men.

HUBER-WARCO
motor graders

designed for rugged haul road work

Balanced weight and power to meet every grading requirement . . . that's the Huber-Warco 5D-190 MOTOR GRADER. A 195 h.p. diesel engine in combination with a torque converter, tail-shaft governor and power-shift transmission gives more power at the blade for faster passes and smoother cuts. Operators like the 5D-190 . . . there is NO CLUTCH . . . they just set the desired speed and the tail-shaft governor maintains the speed regardless of load conditions. The complete hydraulic cab-controlled blade movement is another important feature. In less than a minute, and without ever leaving the cab, the operator can move the blade from a 90° bank sloping position on one side to 90° on the other. There are NO manual adjustments to be made. These bonus features add up to MORE grader production. See your Huber-Warco distributor for complete details on the torque converter and standard transmission graders ranging in horsepower from 75 to 195 h.p.

A product of HUBER-WARCO COMPANY, Marion, Ohio, U. S. A.

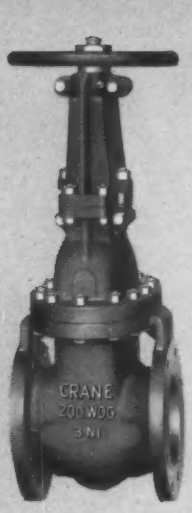
HUBER-WARCO COMPANY, Marion, Ohio, U.S.A.
Send me specifications on the Huber-Warco
☐ 5D-190 ☐ other grader models
☐ Send me the name of my nearest Huber-Warco distributor.

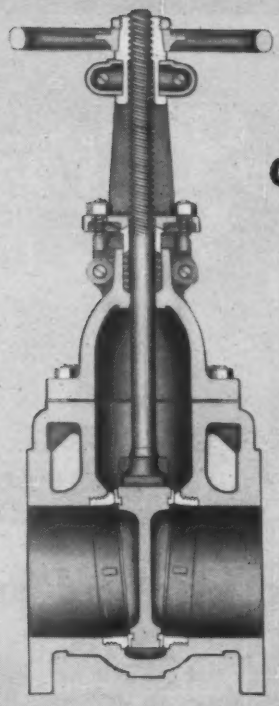
Name _____
Title _____
Company _____
Address _____
City _____ Zone ____ State _____
10-EM

HUBER W WARCO

NEW CRANE VALVES FOR PROCESS INDUSTRIES

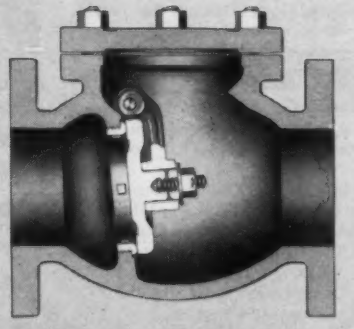
3% NICKEL ALLOY CAST IRON





Gates and Swing Checks

18-8 SMo (Type 316) Alloy Trimmed



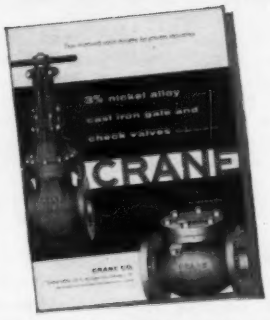
11 SIZES — 2 TO 18 INCHES

Better Corrosion Resistance . . . Longer Life . . . on More Fluids

This metal—Crane 3% nickel alloy iron—was developed especially to extend the usefulness and economy of cast iron valves in the process industries.

At but slightly higher cost, Crane 3% nickel iron valves provide substantially better resistance to corrosion than ordinary cast iron, and they have notably higher physical properties. Efficiency is stepped up further with Crane 18-8 SMo (Type 316) stainless steel trim.

Typical Recommended Applications: You will save with these valves —in the petroleum industry, for example—on oils containing traces of mineral acids; in wood-treating processes—on creosote vapors and oils; in pulp and paper mills—on alkaline liquors of various kinds. In general, they should be considered where all-iron or brass-trimmed iron valves are subject to seat corrosion.



ASK FOR THIS CIRCULAR

Complete technical and specification data on these valves are given in Circular AD-2313. Ask your Crane Representative for a copy, or write to address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas

Michigan (*Continued*)

On August 25th, Pickands, Mather & Co. recalled 619 men at the Newport and Geneva mines at Ironwood. Operations were resumed on a three weeks per month schedule. The mines had been idle for three months.

Stockpile loading at the Buck mine at Iron River, operated by Pickands, Mather & Co., slowed down somewhat in August. The mine was closed down on July 24th.

At Iron River, the M. A. Hanna Co.'s Homer-Wauseca circular, 20 ft dia shaft, sinking of which began on June 18th, 1957, is down about 2000 ft of its 2700 ft planned depth and the shaft house is completed. The Walsh Construction Co. is sinking the shaft. Ledge was reached at 110 ft. Sinking is advancing at the rate of 8 ft per day and is expected to be completed in December. When completed, the new shaft will serve the Homer and Wauseca mines for a future annual production of 1-million tons. The shaft will have three hoists: two for ore and one for men and materials. The two 9-ton ore skips will handle 15½ tons each and will operate at 1890 ft per min.

MINNESOTA

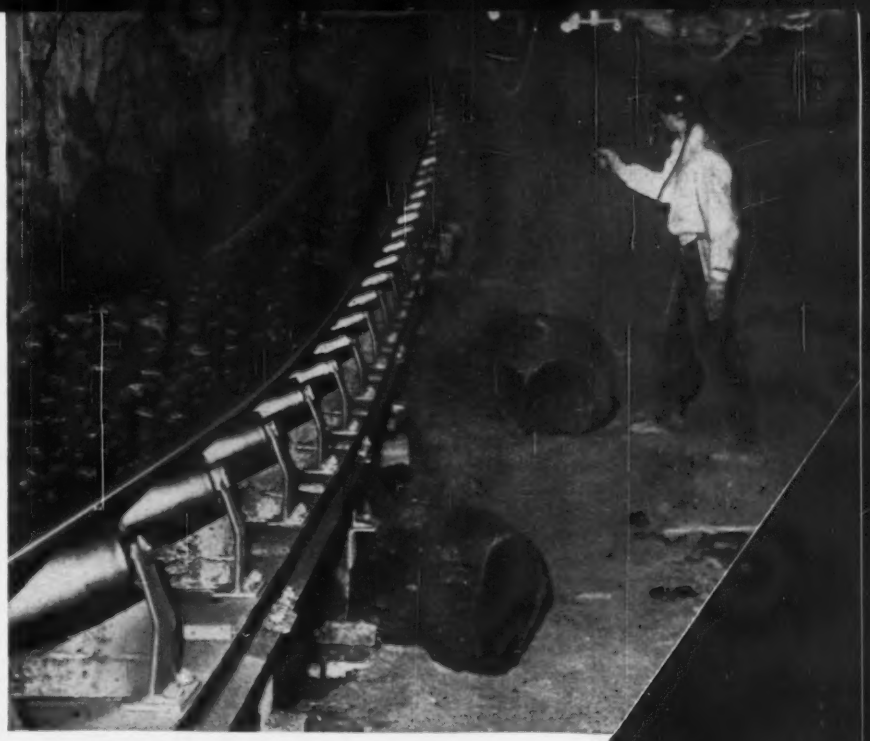
Pickands, Mather & Co. received notice that 18 of their operations in the Lake Superior district have been awarded Certificates of Honor by the Joseph A. Holmes Safety Association for outstanding achievements in safety. The properties recognized included some in the Hibbing district, Erie Mining Co. at Aurora, the Cuyuna range and the Menominee range of Michigan.

Iron ore exports from Venezuela have increased from 198,952 metric tons in 1950 to 15,524,441 tons in 1957. Of that tonnage Orinoco Mining Co. (U.S. Steel Corp.) shipped 12,087,441 tons while Bethlehem Steel Corp. shipped the balance, 3,437,000 tons.

Stocks of iron ore on hand at U.S. and Canadian docks and furnaces are still higher than a year ago; and the number of furnaces in operation is still well below those in 1957.

Jones & Laughlin Steel Corp. has added about 200,000 tons to its schedule and is operating its Columbia mine at Virginia two shifts instead of one. A few men have been added to the Hill-Annex force at Calumet where its heavy media plant is working 19 shifts a week. The plant at the Hill-Annex tailings pond had been closed down because the company's various operations were producing more fines than could be utilized. It would have been necessary to stockpile about 60,000 tons of fines if the plant's operation had been continued. The Longyear mine at Hibbing, idle until about mid-August, is operating one shift on ore and one on stripping.

Fifty-one mines on the Mesabi range have shipped over 10-million tons each.



Thermoid Belting

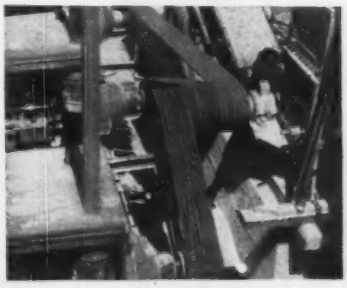
is built to take it... underground!

This is especially true of fire-resistant Thermocoal—the belt that bears acceptance designation #28-13 of the U. S. Bureau of Mines.

You'll not only have a belt that meets or exceeds all after-flame and after-glow tests . . . you'll also benefit from typical Thermoid toughness. Thermocoal Belts are engineered for high resistance to flexing and impact, edge wear, abrasion and mildew. You can specify either 4 or 6 ply construction of the strongest cotton or cotton-nylon duck—impregnated with specially compounded Thermoid rubber stocks to assure longer life, lower costs.

Your Thermoid Distributor can help you select the belting that meets your requirements. Contact him . . . or write direct for detailed information and data sheets.

Make Thermoid your choice, too, for Multi-V Belts . . .

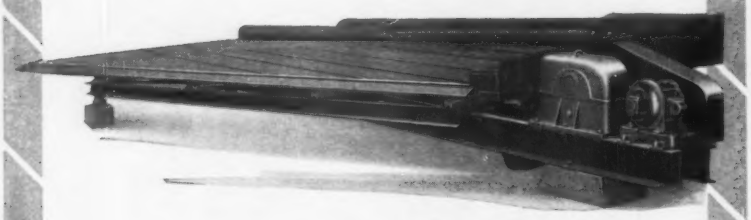


. . . and Hose manufactured with your needs in mind.

Thermoid

Thermoid Company
Trenton, New Jersey
Nephi, Utah

Concentration of Fine-Grind Minerals Is Most Efficient on the SuperDuty® Table



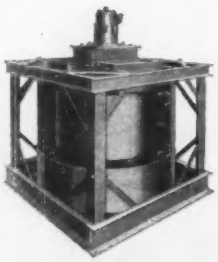
Although the advantages of pool riffling have been recognized for many years, it has remained for SuperDuty engineers to combine and so balance riffle action with all other tabling factors that it is now possible to get highest grade concentrates along with negligible loss to the tailings and greatly reduced middling loads.

This efficiency is accompanied by low operating and maintenance costs, putting the SuperDuty table in the class of equipment you can least get along without.

For full information, send for Bulletin 118-B.

CONCENCO®
Feed Distributor

While unexcelled for feeding concentrating tables, the CONCENCO Feed Distributor effectively provides an accurate splitting of feed into any desired number and proportion of parts to feed circuits or machines in battery for their greater overall efficiency. It is a heavily fabricated all steel machine with motor drive requiring 1 h.p. or less in operation.



THE DEISTER ★ CONCENTRATOR COMPANY
903 Glasgow Ave. • Fort Wayne, Ind., U.S.A.
CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

Minnesota *(Continued)*

The Hull-Rust of Oliver Iron Mining Division leads with 197,176,921 tons up to 1958, followed by the Mahoning with 116,176,217 tons. The Vermilion range has four mines in that class: the Pioneer, Zenith, Soudan and Chandler. The Pioneer has a total of 34,492,692 tons up to 1958.

Reserve Mining Co. at Babbitt and Silver Bay, in late August began on a seven day week, three shifts per day schedule. Since March it had worked for four weeks, then shut down for one week. The new schedule is due to "a somewhat improved operating rate in the steel industry."

The Pittsburgh-Pacific Co. of Hibbing made a high bid of $650,000 for the Ramapo Mountain iron mines at Ringwood, N.J. The property contains 232 acres and has two known ore deposits. It was taken over by the General Service Administration in 1955 when it foreclosed a $1.4-million mortgage on the Ringwood Iron Mines Co. No plans have been made for reopening the property.

MONTANA

Geological mapping crews of the Montana Bureau of Mines and Geology, Montana School of Mines, Butte, have started work on a mineral resources exploration program in the Troy-Libby area. The program is sponsored by the Great Northern Railway and Pacific Power & Light Co.

Dr. E. G. Koch, director of the state bureau, said the mapping crew under Willis M. Johns, Bureau geologist in charge of the project field station, is working in the Yaak River quadrangle north of Libby. Johns has moved to Kalispell from Butte.

Koch said the work is part of the five-year geological and minerals exploration program the two companies are sponsoring in cooperation with the Bureau in sections of Lincoln, Flathead and Lake counties.

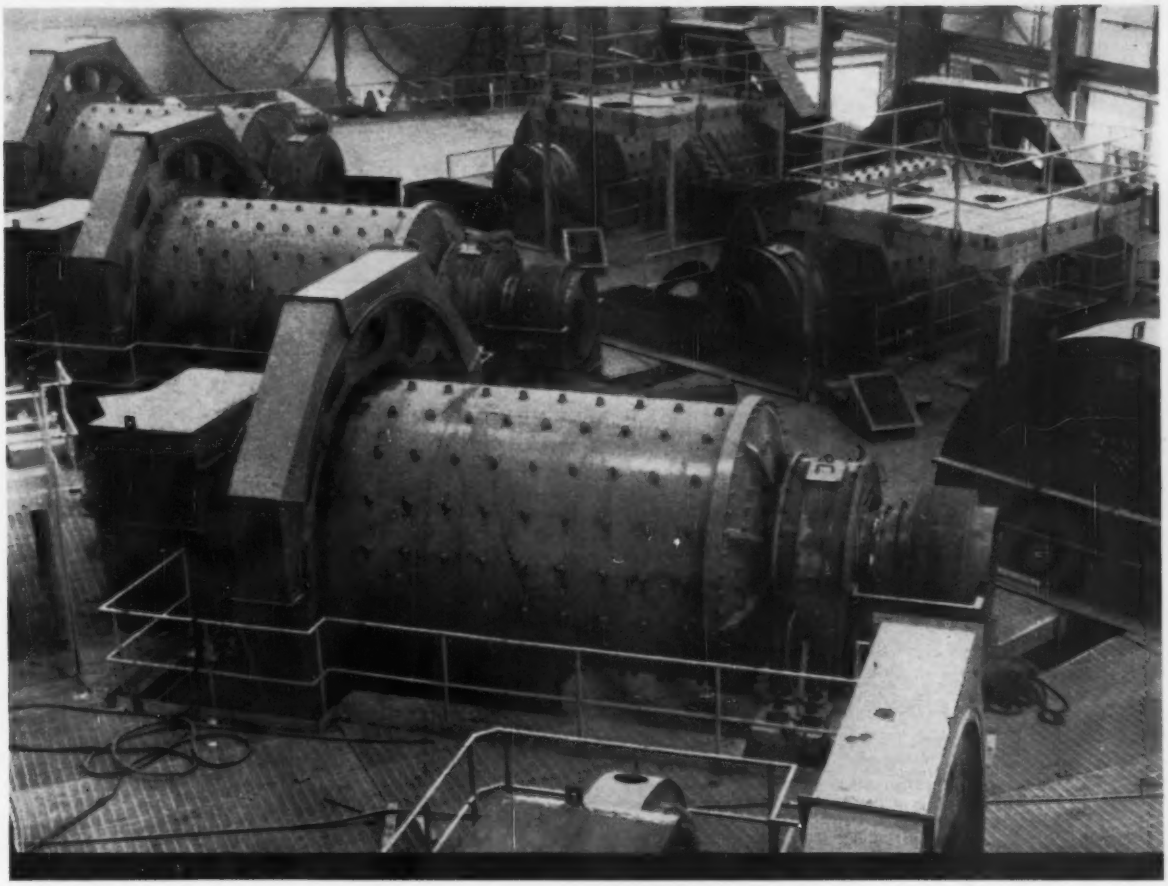
Ultimately, the project will complete reconnaissance of some 6,800 sq miles of northwestern Montana.

Three Glasgow businessmen have formed a company to develop a bentonite deposit that may run as much as 26-million tons of mineable material.

Robert Hansen, Robert Hurley and Leslie Hanson have incorporated the Brazil Creek Bentonite Co. to develop the deposit, about 15 miles west of Glasgow.

NEVADA

The Eagle-Picher Co. scheduled the formal opening of its new $2.5-million diatomaceous earth processing plant at Colado for early October. Construction of the big mill is nearly completed, according to officials of Kaiser Engineers, the firm in charge of the installation work. Colado is six miles east of Love-



for tough grinding problems KENNEDY Ball and Rod Mills

KENNEDY Ball and Rod Mills solve the toughest grinding problems by providing dependable wet or dry grinding at low cost and with minimum maintenance. Consult KENNEDY and learn more about these features that distinguish KENNEDY Grinding Mills:

- Cast steel or Meehanite heads
- Welded and stress-relieved heavy steel plate shells
- Large diameter trunnions
- Self-aligning bearings with adjustable sole plates
- Positive "Ferris Wheel" lubrication of main bearings
- Oil-tight bearing seals
- Motorized hydraulic lift to reduce starting torque
- Single helical cast steel gear and pinion

KENNEDY VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.

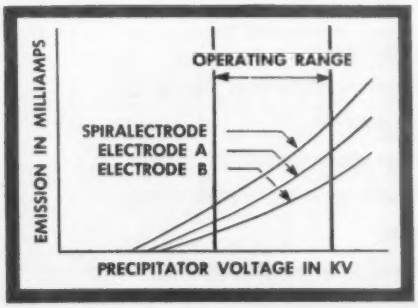
Primary & Secondary Gyratory Crushers • Jaw Crushers • Roll Crushers • Impact Breakers • Hammer Mills • Rod & Ball Mills • Kilns Dryers • Screens • Conveyors • Complete Crushing, Lime and Cement Plants. KENNEDY Research & Testing Services.

1500 miles of Spiralectrodes in Precipitator Service!

That's real proof of superior performance. Over 1500 miles of these emitting electrodes have been installed in 'SF' electric precipitators . . . delivering 50 to 100% more electron emission than conventional types of electrodes.

There are sound reasons why Buell *Spiralectrodes* are providing superior emitting efficiency in actual dust collecting applications.

- *Spiralectrodes* are *"emission engineered"* – pitch and diameter are custom designed for each application . . . of critical importance with high resistivity dust.
- *Spiralectrodes are precision made from stainless steel*– of uniform quality, corrosion-resistant.
- *Spiralectrodes minimize efficiency-loss of dust build-up* –no horizontal surface to collect dust, positive rapping cleans electrodes.
- *Spiralectrodes maintain predetermined tension* – (no weights required) . . . dampen effect of vibration caused by electrical pulsation, thereby minimizing electrode breakage.
- *Spiralectrodes'* controlled area emission stops sparking effect of "point emission."



Above chart illustrates the superior emission of the Spiralectrode: its corona voltage is lower and its emission is higher than other types of emitting electrodes over the entire operating range of industrial precipitator voltage.

The superior operating characteristics of Spiralectrodes contribute to continued high efficiency of Buell 'SF' Precipitators. Detailed information of this and other exclusive features are described in a booklet, "Buell 'SF' Electric Precipitators." Send for your copy: write Dept. 19-J, Buell Engineering Company, Inc., 123 William Street, New York 38, New York.

buell®

Experts at delivering Extra Efficiency in

DUST COLLECTION SYSTEMS

Nevada *(Continued)*

lock near the Southern Pacific mainline, and the mill will process material from the Trinity range west of Lovelock, where large deposits have been located. Ralph Yocum, plant superintendent, said that top officials of Eagle-Picher are expected to be present at the opening ceremonies. Robert Noble has been appointed chemist for the new operation, and Robert Maher will be foreman at the plant. Wells Cargo Co. has been awarded the contract for trucking ore from the mine to the mill, and will employ 20 men.

White Caps Mining Co. at Manhattan installed larger pumps during August, opening the way for de-watering and timbering the shaft to the 1300 ft level. The Nye County property has already been de-watered to the 800 ft level, and the main shaft and all drifts had been opened and placed in good shape to that point. A shipment of antimony ore from the mine early in August contained 15 tons from the 300 ft level and assayed more than 50% antimony. The shipment was trucked to Morris P. Kirk in Los Angeles.

Great Lakes Carbon Co.'s big dicalite plant near Basalt in Esmeralda County is producing 85 tpd and employing 36 men. Large deposits of the non-metallic ore are being stripped from areas close to the plant site, and the product is used commercially as a filter aid and for paper making.

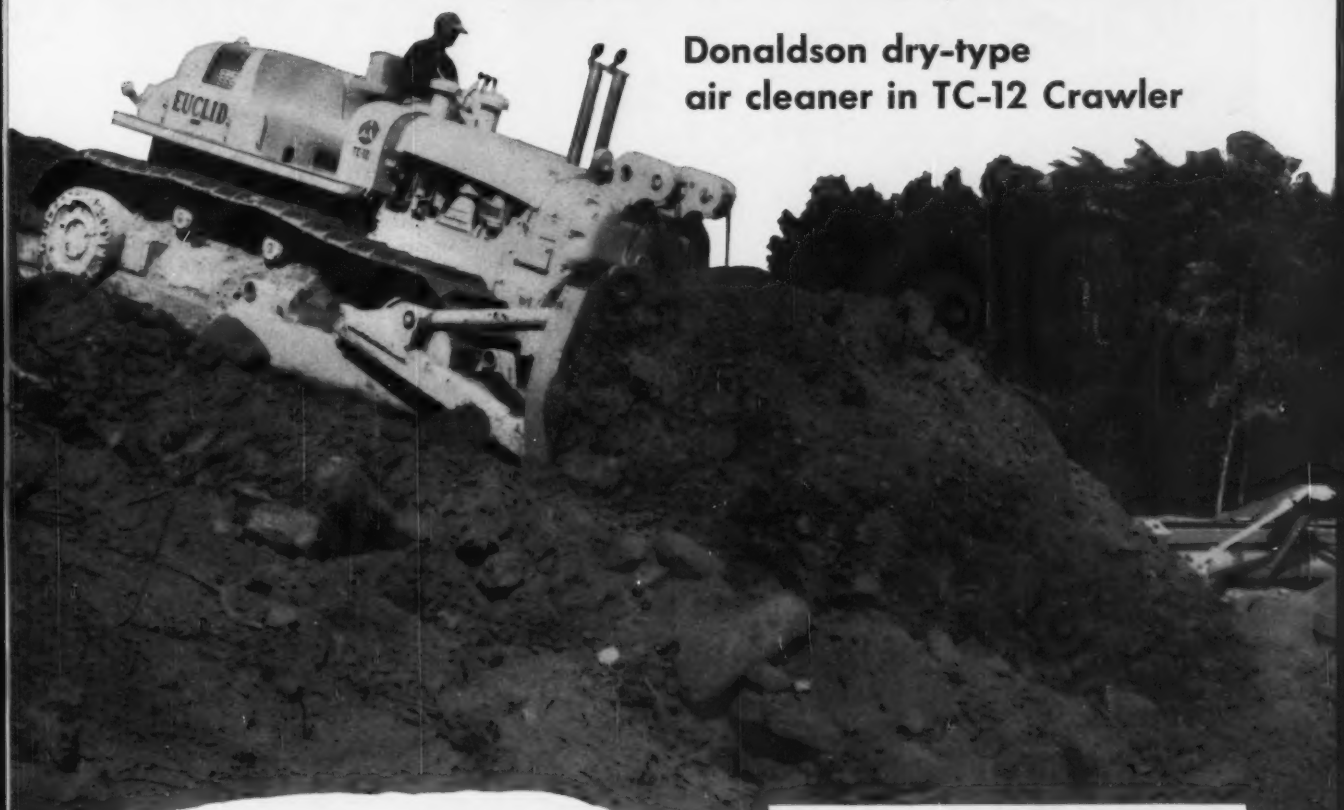
Leonard Shellenbarger is producing 200 tons of talc per month from the Marlin MacBoyle property in Esmeralda County's Palmetto District, which he is leasing. A good open pit operation has been developed and three men are engaged in the work. High grade material is sent to Sierra Talc Co., at Keller, Calif., and low grade material is hauled 70 miles by truck to Huntley Industrial Minerals at Bishop.

Sulphur Products Inc. is producing a steady output of sulphur and some cinnabar from its mine southeast of Sulphur in Humboldt County. Henry Crofoot, head of the company, announced that the output of mercury depended on location of water in the area. A well is being dug, and, if enough water is found, a retort will be constructed.

Shipments from the Ohio Gold Mine property at Gold Point are being made by the U.S. Mining and Minerals Corp. Six men are at work on the site, and shipments are going to the firm's mill at Silver Peak, Esmeralda County. Ore is also being hauled to the mill from the Liberty mine at Silver Peak at the rate of 150 tpd. New equipment added to the mill has increased the efficiency and recovery rate, according to company officials. An automatic sampler was added early in August and gave good results.

Henry Ott, Round Mountain mining man, has acquired ownership of the Barber Canyon Placer Channel near Winnemucca. Ott tested the two-mile

Another EUCLID product improvement!



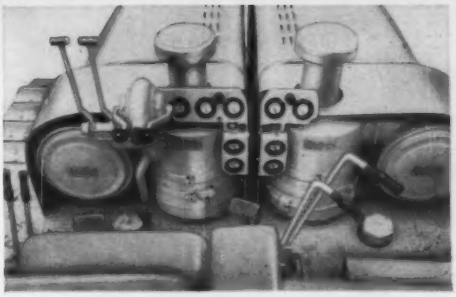
Donaldson dry-type air cleaner in TC-12 Crawler

One of the reasons the new series Euclid TC-12 Crawler provides more work-ability with less down-time is the unequalled accessibility of all major components for quick, easy servicing.

As shown in the photograph, the two Donaldson dry-type air cleaners, one for each engine, are conveniently located for easy access. Both pre-cleaner and secondary filter can be serviced in a fraction of the time required for oil bath cleaners and there's no mess—just empty the pre-cleaner dust cup, clean and replace a paper element in the secondary cleaner.

HIGH EFFICIENCY CLEANER INCREASES ENGINE LIFE

The Euclid TC-12 Crawler is now being built with the Donaclone dry-type air cleaner as standard equipment. This 99.9% efficient cleaner reduces engine wear caused by dust—increases the service life of the engine and helps maintain top operating efficiency. Engine manufacturers say that 8 ounces of



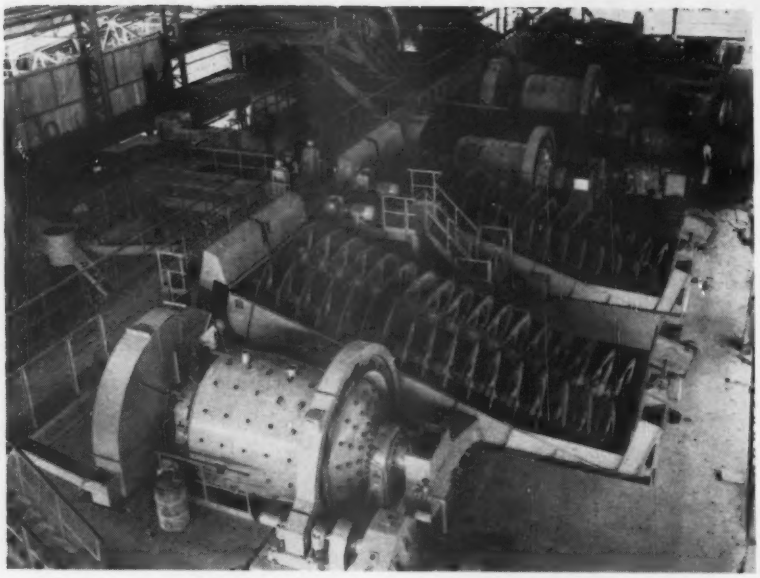
abrasive dust can ruin an engine in a short time. Because of the tremendous volume of air that passes through an engine in a single shift, the importance of air cleaner efficiency is obvious. That's why Euclid uses this Donaldson cleaner on the new series TC-12 . . . it's another example of constant product improvement that makes Euclid your best investment.

EUCLID Division of General Motors, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

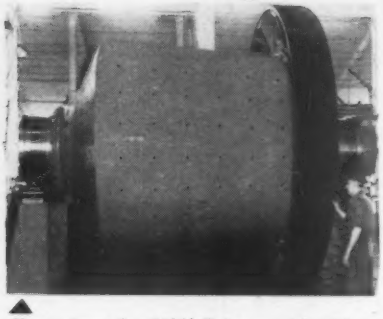
EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE



Shown here are four Hardinge 9-3-6-8 Tricone Mills grinding sulfide copper ores and mixed ores in a concentrating plant in the Belgian Congo, Africa.

CORRECT BALL SEGREGATION
in the
Hardinge TRICONE MILLS

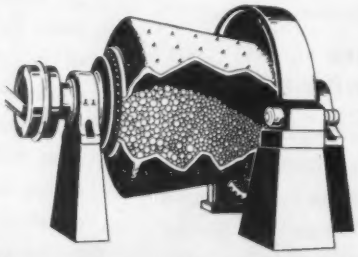


Shop view of a 10½′ Tricone with 9′ long tapered shell.

Highest grinding efficiency and lowest ball and lining wear are common to mills with a correctly segregated ball charge. The Hardinge Tricone Mill is the only mill providing these essentials to low cost operation without the use of special linings or internal devices, which are subject to wear and are effective through only a part of their wearing life.

The Tricone also occupies less floor space for its grinding volume than any other ball mill built.

Every ball in the Hardinge Tricone Mill "minds its own business!" ▶



Complete specifications upon request, Bulletin AH-414-1.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 ARCH ST. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco • Birmingham • Jacksonville Beach

Nevada *(Continued)*

placer channel by shaft sampling and churn drilling, and said he located 2-million cubic yd that will average 80c per yard. The property, according to Mr. Ott, also contains 1.5-million yards of commercial gravel.

NEW MEXICO

Purchases of uranium ores by the U.S. Atomic Energy Commission at its Grants ore-buying station ended on October 1, 1958, according to an announcement by Manager Allan E. Jones of the Grand Junction Operations Office.

The Commission opened its Grants ore-buying station on July 5, 1956, near the Junction of the San Mateo Road with U.S. Highway 66. This station provided a temporary market for uranium ores produced in several mining districts of New Mexico during the planning and construction of the new uranium processing plants in the Ambrosia Lake area.

Uranium processing plants are now operated by The Anaconda Co.; Homestake-New Mexico Partners; Homestake-Sapin Partners; and Phillips Petroleum Co. in the Grants area and Kermac Nuclear Fuels Corp. is constructing a fifth plant. Each processing plant operator is required to feed a certain amount of ore produced by independent mine operators to his processing plant and thereby maintain a market for the independent mine operator. The new plants in the Grants area use both alkaline and acid leaching methods and provide flexibility in treating the various types of ore that are produced in the area.

The processing plants now in operation are currently furnishing a market to independent producers of amenable uranium ore produced in the area. The continued operation of the Grants ore-buying station was no longer required since these other markets are now available.

Rare Metals Corp. of America has developed more than 1-million tons of ore at its San Mateo mine in Ambrosia Lake, according to the firm's interim report. Ore averages 0.26% U_3O_8, and is being reached at 1,100 ft. Shaft is down to 880, where water was encountered. Sinking will continue when water is brought under control.

OREGON

Work is under way at the Buffalo Mine in Grant County to open a new and deeper operating level. The new adit, approximately 1400 ft in length, will intersect all known veins at a depth of approximately 230 ft below the present working level.

There has been activity at four gold mines in Josephine and Jackson Counties. The Daisy mine in sec. 14, T 34 S, R. 5W., Josephine County, is being leased to R. C. Hanford, who is doing underground exploration.

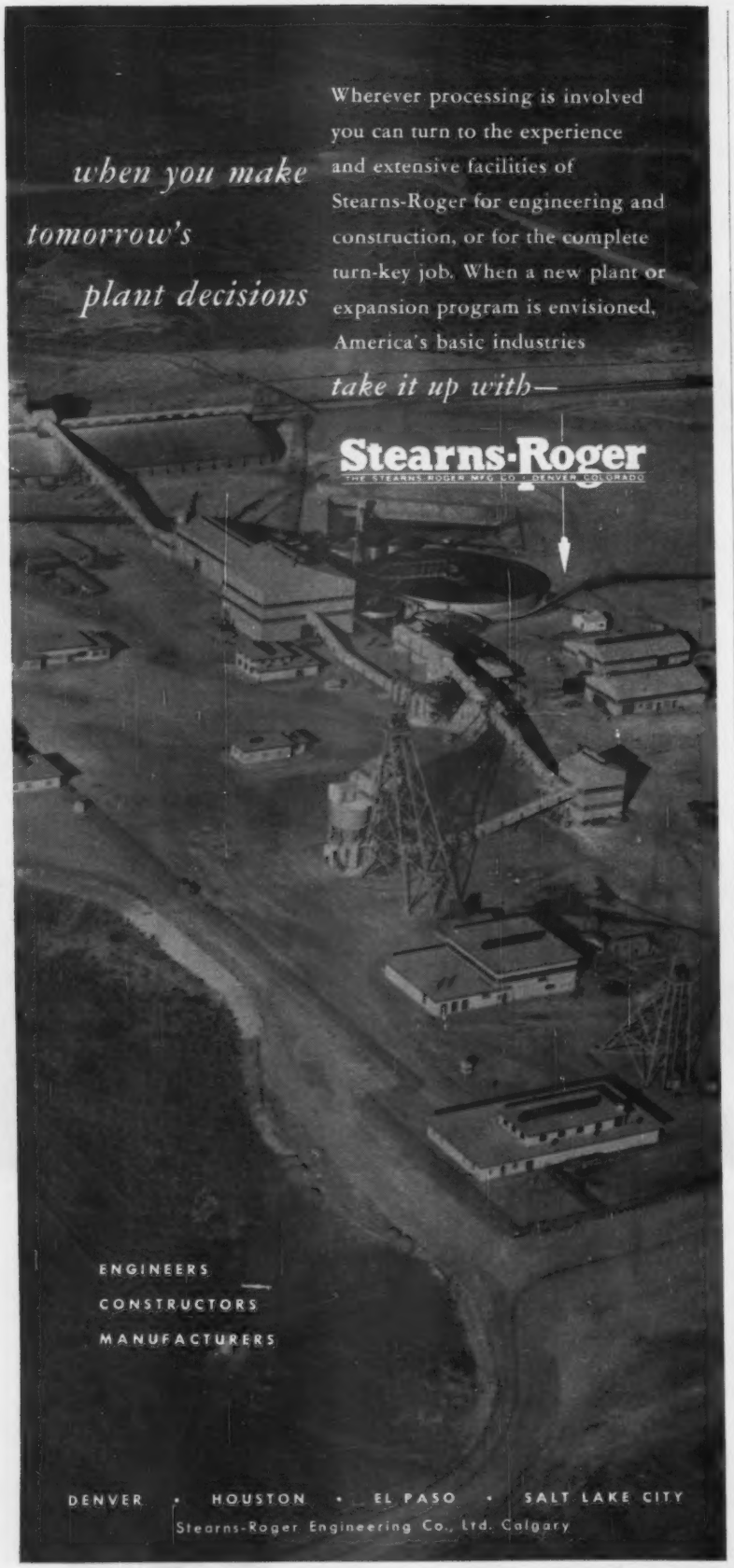
The Humdinger mine, about 25 miles

Can Move 12,000 Tons Daily. This is the gunboat plane of the Coaldale Mining Company, Coaldale, Pa.—one of the most efficient inclined haulageways you'll find. Loads from the rotary dump are whisked up the plane to the breaker, where only a few seconds are required for the drop. Though the plane is built at a steep 61 degrees, the high-powered system can handle more than 12,000 tons of coal in a normal working day.

The balanced hoist is rigged with Bethlehem Type U wire rope, Purple Strand grade. Type U is a 6x21 construction combining strength, flexibility, and abrasion-resistance. This tough, durable 2-in. rope has always proved a match for the heavy loads and uphill pull at the Coaldale incline.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:
MINING • QUARRYING • CONSTRUCTION • EXCAVATING • PETROLEUM • LOGGING • MANUFACTURING


when you make
tomorrow's
plant decisions
Wherever processing is involved you can turn to the experience and extensive facilities of Stearns-Roger for engineering and construction, or for the complete turn-key job. When a new plant or expansion program is envisioned, America's basic industries
take it up with—
Stearns-Roger
THE STEARNS-ROGER MFG. CO. • DENVER, COLORADO
ENGINEERS
CONSTRUCTORS
MANUFACTURERS
DENVER • HOUSTON • EL PASO • SALT LAKE CITY
Stearns-Roger Engineering Co., Ltd. Calgary

Oregon *(Continued)*

south of Grants Pass in secs. 21 and 16, T. 38 S., R. 5 W, Josephine County, is being worked intermittently by Earl Young of Grants Pass.

The Reno mine in the Galice area, Josephine County, is being worked by Quentin Stone of Grants Pass.

Frank Gelhaus of Rogue River is mining and milling high grade ore from the Warner mine in sec. 4, T. 33 S., R. 4W, Gold Hill district, Jackson County.

Western Minerals, Inc., Lakeview, is producing and shipping quicksilver from a new cinnabar occurrence on Angel Peak about 5 miles east of Quartz Mountain in western Lake County. The company has erected a 30-ton Lacey furnace. The Four Square group of claims are leased from Johnson, Tomlin and Morrison of Lakeview. Operators are Phil Parks Jr., Roy Matchett and G. I. Bryant.

Completion of the head-frame for the new uranium production shaft at the White King Mine, Lake County, has been announced by the Lakeview Mining Co. The new structure is all steel, 96 ft high and contains two ore compartments of 100 tons capacity each. Hoist for the shaft, a 150 hp double drum unit, has been installed and tested. The company hopes soon to resume sinking operations in this shaft, which will go down to 700 ft at an estimated initial cost of $500,000.

UTAH

White Canyon Mining Co., which is controlled by Texas-Zinc Minerals Corp. (purchasers of the famed Happy Jack mine), is stepping up its exploration program for uranium ore in the White Canyon district.

"Disappointing showings from underground development made it necessary to start an extensive drilling program in order to make a geological reappraisal of our ore potential," White Canyon stockholders were told in a recent report from management.

A major factor is failure of an expected "continuous" channel of ore to appear in the Hideout Mine, White Canyon's principal producer. Presently, the firm is shipping between 3,000 to 4,000 tons monthly to the Texas-Zinc mill at Mexican Hat, Utah.

Bullion Monarch Mining Co. has resumed exploration on its own account on two of its Farmer John claims in the Marysvale district.

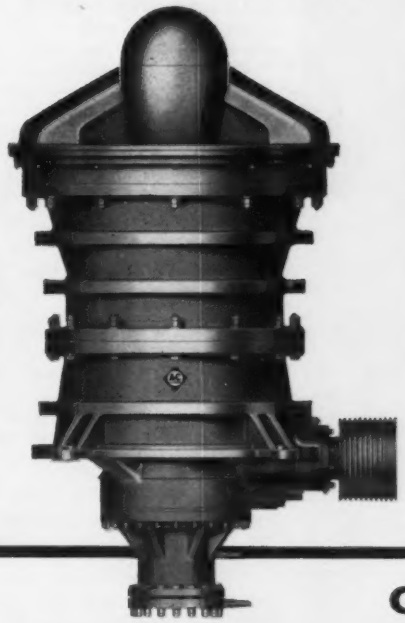
Arch Wackerli, Idaho Falls, Idaho, president of the company, said that a 500-ft tunnel, with laterals, would be driven into the claims in the ore prospect.

Other claims of the firm are operated by Vanadium Corp. of America with royalties going to Bullion.

Ranrex Oil and Mining Co. headed by H. R. Feller has acquired all the beryllium claims of Utah Beryllium Co., Inc.

Mr. Feller said a development program would begin immediately.

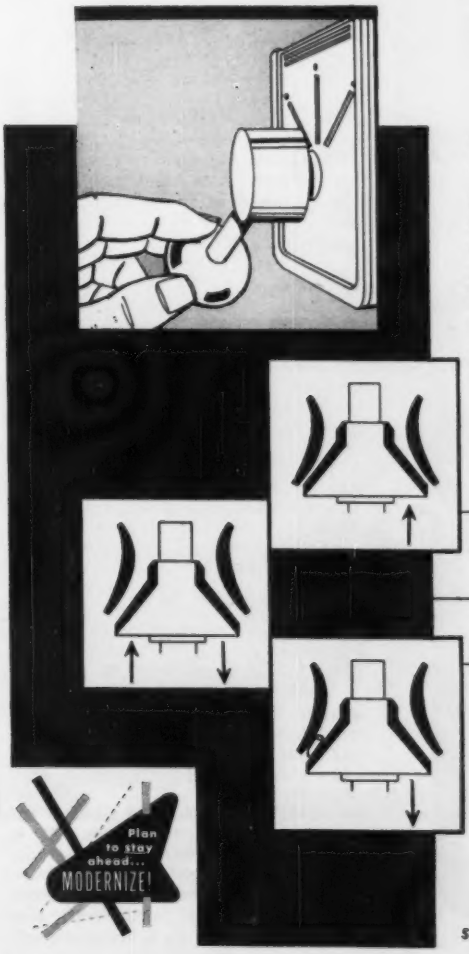
Superior Primary and Secondary Crushers. Send for Bulletin 07B7870.



Hydrocone Secondary and Tertiary Crusher. Send for Bulletin 07B7145C.

Only Allis-Chalmers gyratory crushers have exclusive

Hydroset mechanism...



HUNDREDS of crushing operators around the world have improved their plant efficiency and tonnage with Allis-Chalmers gyratory crushers equipped with *Hydroset* mechanism. This remarkable design feature has provided economy and convenience in crushing a wide range of materials — from andesite to zinc ore, and including the crushing of taconite in the world's largest crusher. No other gyratory crusher even approaches the time-saving advantages of "one-man, one-minute" product control offered by Allis-Chalmers crushers equipped with *Hydroset* mechanism.

"One-Man, One-Minute" product control

Hydroset mechanism raises or lowers the mainshaft hydraulically in less than a minute — at the flip of a switch.

Compensates for wear on mantle and concave ... saves hours of production time — with the flip of a switch.

Changes crusher settings in less than a minute — with the flip of a switch.

Clears crushing chamber in case of power failure or other emergency — with the flip of a switch.

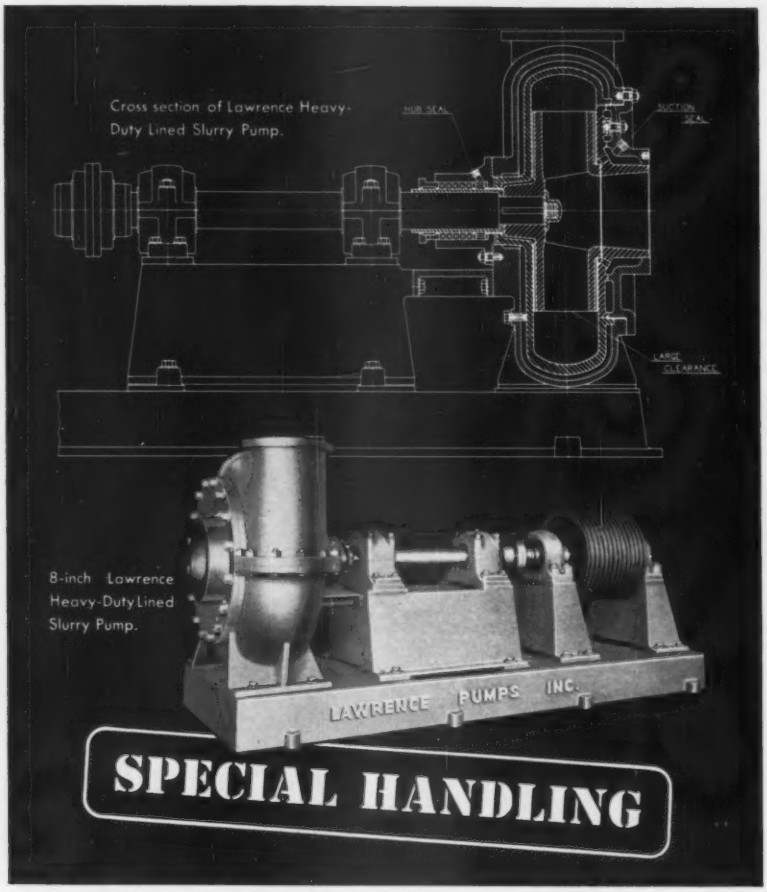
The A-C man in your region will gladly give you all the details. Or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wis.

Plan to stay ahead... MODERNIZE!

ALLIS-CHALMERS

Superior, Hydrocone and Hydroset are Allis-Chalmers trademarks.

A-5607



for heavy abrasive slurries with solids in suspension

Where abrasive wear is unusually severe or could cause severe damage if the casing wore out, a Lawrence Lined Slurry Pump provides the answer.

The pump is built with a casing liner, disc liner and impeller made of hard, brittle, abrasion-resistant alloy such as manganese steel, Ni-hard, etc. As the casing is designed to withstand full pressure, the liner can be used until actually worn out. Renewal of both the liner and the impeller (if necessary) is very simple because the casing is split horizontally.

The impeller is made with extra large clearances to prevent clogging. Sealing connections are provided on the suction disc and on the hub to flush out any grit or solid matter to prevent wear at these points.

For complete information about Lawrence Slurry and Sludge Pumps write for Bulletin 207-4.

LAWRENCE PUMPS INC.
371 Market Street, Lawrence, Mass.

Utah *(Continued)*

United Park City Mines Co. reported a net loss of $94,373 for first six months 1958, compared with a loss of $53,960 for like period a year ago.

Company management announced that "continued depressed prices of lead and zinc, due to excessive foreign, low cost production, makes it necessary to operate without any long range development work. This is done in order to hold operating losses below the cost of closing down the mine and suffering shut down expenses."

Radorock Resources, Inc., Salt Lake City, shipped 69,720 tons of 0.774% U_3O_8 valued at $2,902,037 for fiscal year ended April 30, according to firm president, Ralph W. Neyman.

The company, with operations in the Big Indian district of San Juan County, recorded a net profit of $1,737,778 for the fiscal year. Hecla Mining Co. is operating agent at the Radon mine for Radorock.

Mr. Neyman said that Radorock shipped 5,800 tons of ore monthly during the fiscal term. A re-evaluation of reserves, he said, resulted in addition of 275,000 tons. Estimated ore remaining in the mine is approximately 430,000 tons of average 0.73% U_3O_8.

The firm is renegotiating its sales contracts with Uranium Reduction Co. for extension of these contracts until Dec. 31, 1966.

Mr. Neyman also announced that Hecla has completed a drift into the adjacent Hot Rocks claims in the district and is preparing to start mining a 35,000 ton ore body where values run about 0.37% U_3O_8. Radorock will participate with Federal Uranium Corp., the parent firm, in a mill proposal in the Gas Hills district of Wyo., where the two companies have developed 1-million tons of 0.26% U_3O_8 amenable to open cut mining. Another million tons of uranium ore are inferred, Mr. Neyman said of this prospect.

Radorock balance sheet shows current assets of $2,103,709, including $224,128 in cash and $1,098,172 in U.S. Government securities.

A 1,000-ft, 3-compartment shaft will be sunk to the St. Regis formation at the Conjecture silver mine in the Coeur d'Alene district by Federal Uranium.

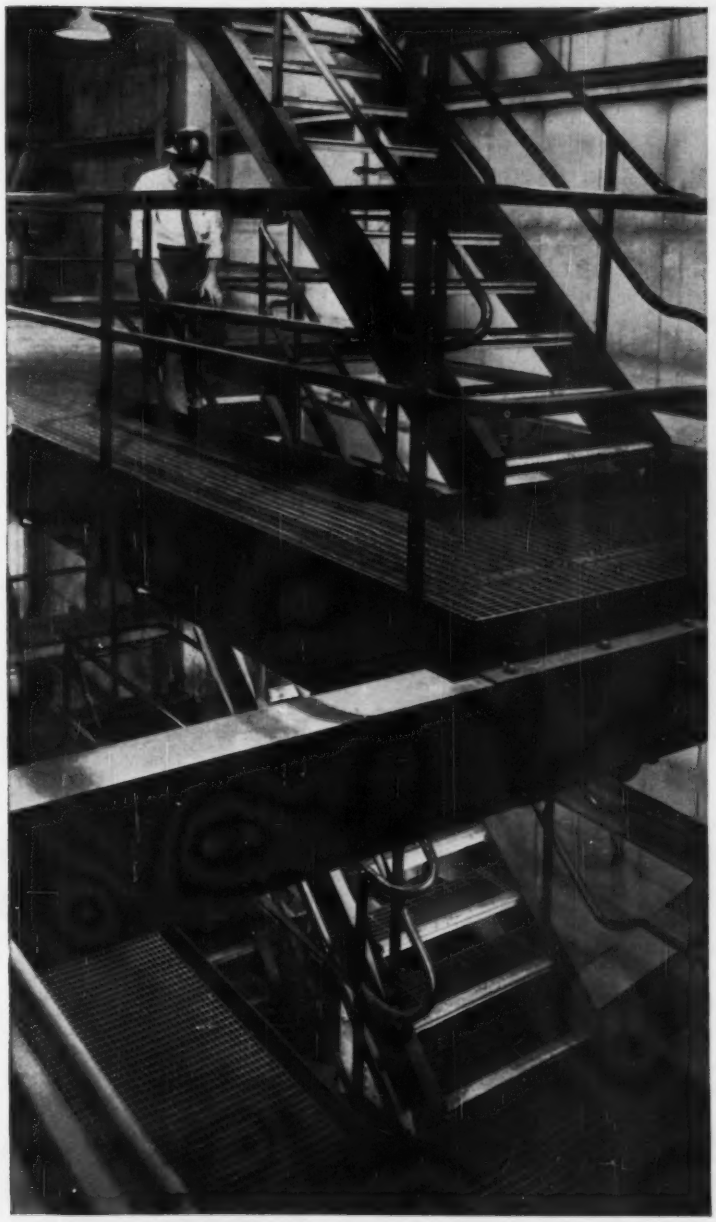
Ralph W. Neyman, Federal president, said the St. Regis is host to much of the high-grade silver deposits found in the district.

It is only about 150 ft down from the present (internal) 700-ft level of the Conjecture to the St. Regis, he said.

Federal already has developed two separate, high grade silver ore bodies on the 700-ft level. One is a 150-ft exposure, four ft wide, and the second runs a like distance but is six ft wide, he said.

Bear Creek Mining Co. has made an important find of lead-silver-zinc ore in Utah's East Tintic District The firm is domestic exploration subsidiary of Kennecott Copper Corp. Kennecott's vice president of exploration, James Boyd, says only that the discovery is "encouraging."

Where a misstep costs $500... Blaw-Knox Electroforged® Steel Grating provides safer non-slip footing



Stair falls cost industry over $60,000,000 a year.

An average accident amounts to a loss of $500 in claims and a loss of 320 days.*

A good way to guard against these profit-eating accidents is to construct your stair treads, walkways and floors with Blaw-Knox Electroforged Steel Grating. Non-slip twisted crossbars and a wide variety of bearing bars are available to meet every kind of working condition—safely solving the most hazardous skid situations.

Rigid, one-piece construction makes installation easy. Once on the job, Blaw-Knox grating practically takes care of itself. There is nothing to wear, nothing to patch, no dirt collecting corners to clean. It goes anywhere, fitting neatly around pipes, beams and machinery, admitting plenty of light and air to the area.

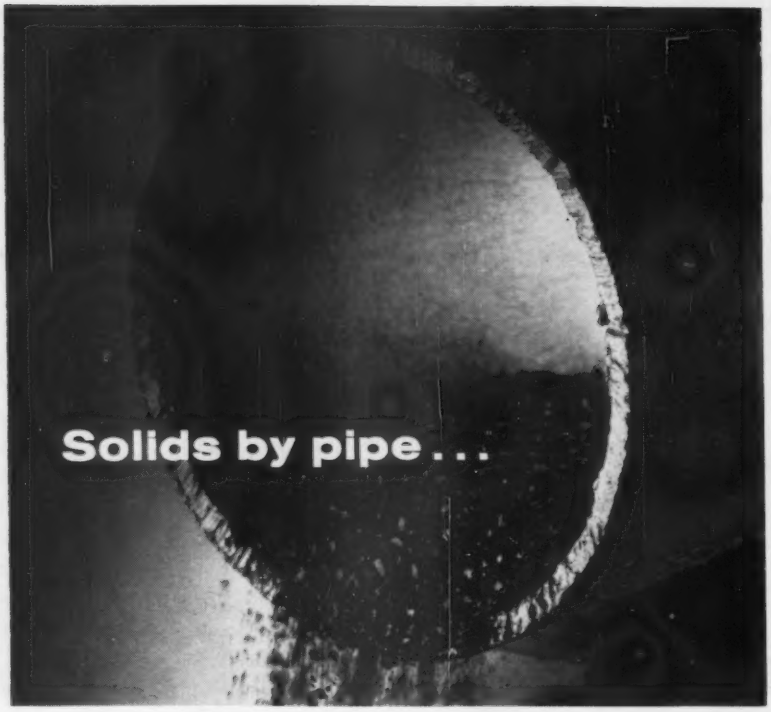
Made to your specifications, Blaw-Knox grating provides new highs in safety, easy up-keep and flexible application. For new ideas about grating—including space saving platforms and shelving, write for Bulletin 2486.

*Based on a study analyzing 803 compensable work injury claims closed in Illinois involving stairs and steps.

BLAW-KNOX

BLAW-KNOX COMPANY

Equipment Division
Dept. S, Pittsburgh 38, Pennsylvania



Could this idea save you a million dollars a year?

Moving solids by pipe line is no longer a dream. It's a highly practical transportation method offering you tremendous economies.

For example, the solids pipe line built by American Gilsonite Co. saves more than $4 per ton—a million dollars a year—over other methods of transporting Gilsonite ore over a mountain from mine to refinery.

Helping to make these savings possible are LIGHTNIN Mixers which keep 700 T/D of Gilsonite uniformly suspended for dispatch through this pioneer pipe line.

Gilsonite, coal, and metallic copper are just a few of the raw materials being handled now with LIGHTNIN Mixers. LIGHTNINS unfailingly provide the *uniform concentration* which is a must in pipe line transportation of solids. If a material can be slurried, you can slurry it with LIGHTNIN Mixers—to the exact level of uniformity needed.

If you'd like quick, competent help on slurry suspension for a specific project, call in your LIGHTNIN representative now. He's listed in Thomas' Register. Or write us in confidence.

Good mixing helps move Gilsonite over a mountain

Solids pipe line built by American Gilsonite Co. carries slurries averaging 38% Gilsonite and 62% water at 350 gpm. It delivers more than 700 tons of solids per day at the downstream end, 80 miles from the eastern Utah mine.

Cut from the vein with high-pressure water jets, ore is flumed more than a mile to the 800-foot-deep central shaft. Then it's screened to 8-mesh maximum, pumped to the surface with fluming water, and mixed to uniformity in 200,000-gallon holding tanks equipped with LIGHTNIN Side Entering Mixers, one of which is shown here.

"Lightnin® Mixers" MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 234-k Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.

Utah *(Continued)*

He did not comment on the report that a core hole from the surface came up with 56 ft of ore, assaying 7% Pb, 17% Zn and 1 oz Ag per ton. Mr. Boyd said that: "One core hole doesn't make a mine."

But significantly, Bear Creek has resumed drifting and cross-cutting off a 1,000 ft exploration shaft. Drilling also continues from the surface.

The core hole in question was on ground controlled by an affiliate of Chief Consolidated Mining Co., Eureka, Utah. This firm is participating in the Tintic "unit" operated by Bear Creek with the Tintic group of companies, among them Tintic Standard Mining Co.

McFarland and Hullinger, Tooele mine contractors, have suspended lease work on the Ophir mine of the United States Smelting, Refining and Mining Co. They have worked the lead-silver-zinc property since 1944, producing an average of 1,500 tons of ore monthly. Some 25 miners were let out with the end of operations.

F. G. McFarland, co-partner with S. R. Hullinger, also announced that within a short time they would likewise suspend operations at the San Xavier lead-zinc-silver mine in Arizona's Pima district.

Western Contracting Corp., Sioux City, Iowa, has been awarded a $5-million stripping contract by Kennecott Copper Corp.'s Utah Copper Division.

The firm will start stripping some 8-million yards of waste overburden from the upper levels on the east and west sides of the huge Bingham open cut mine by Oct. 15, 1958.

It will take Western Contracting about a year to move the waste overburden. During that same period, regular employees of Utah Copper Division will, in the course of mining, remove some 17-million tons of waste overburden.

F. C. Green, Utah Copper Division general manager, said that a 400,000 yd dike fill project at the tailings pond between Arthur and Magna mills had been awarded to Gibbons and Reed Construction Co., Salt Lake City.

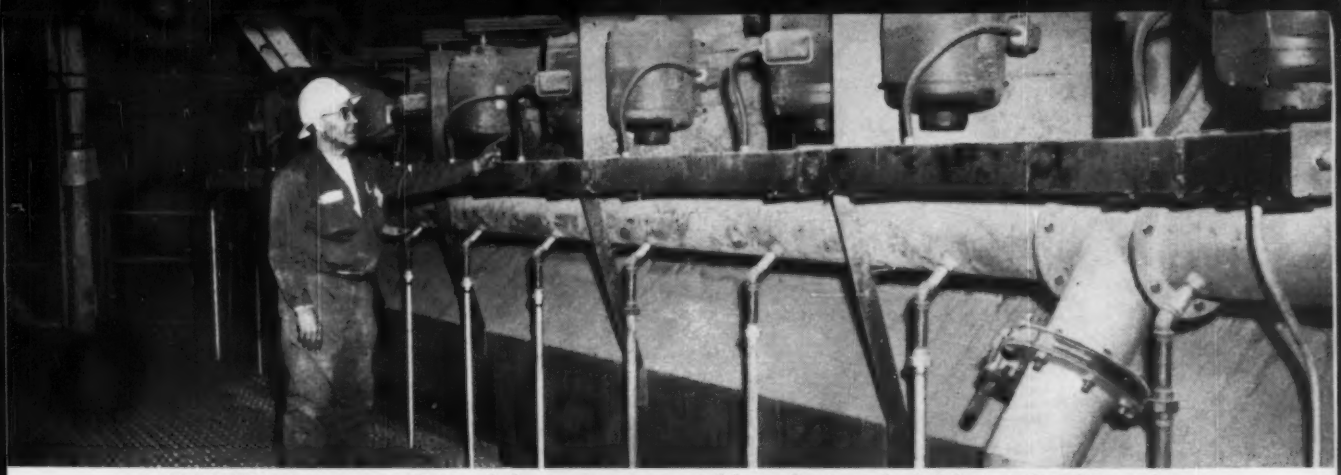
Western Gold & Uranium, Inc., reported net profit of $296,420, before a $71,940 special property loss write-off, for the six months' period ended on July 31, according to the semi-annual statement.

The company also reported the election of Ralph G. Brown, one of the founders of the company in 1944, and president since 1951, as chairman of the board, and the appointment of Russell R. Richards to succeed him as president.

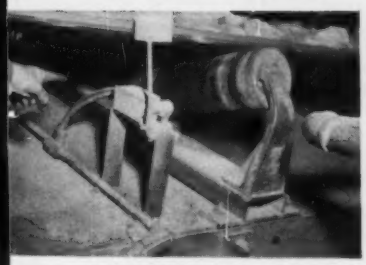
Mr. Richards comes to Western Gold & Uranium as the company begins major exploitation of the Orphan mine in the Grand Canyon.

During the six-month period, the company produced 6,394 tons of uranium ore averaging slightly more than 1% U_3O_8. This compares to a total of 7,303 tons of ore averaging 0.86% U_3O_8 produced in all of 1957.

Standard Uranium Corp. has apparently developed a substantial new body of

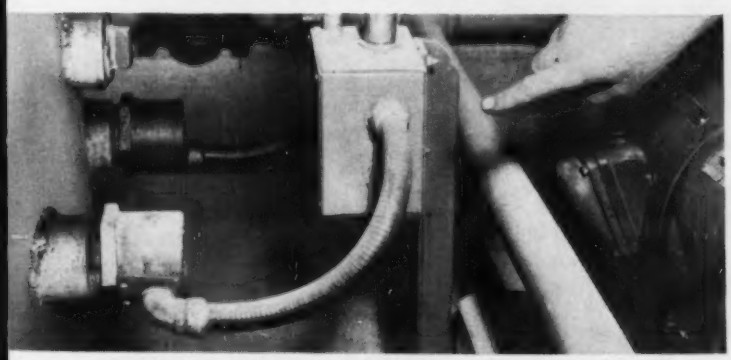


FLOTATION CELL motor connections with the raceway are protected from vibration and splash by ½-inch Sealtite conduit.

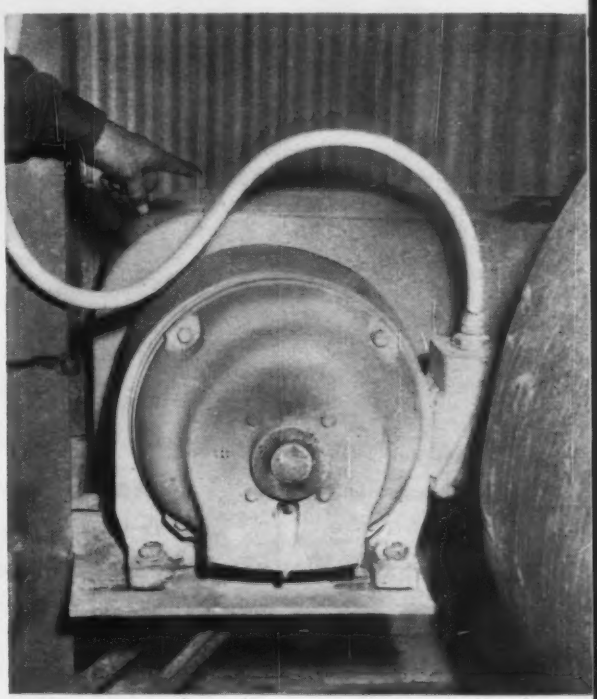


CONVEYOR side-travel switch connections are protected from spilling rock by ½-inch Sealtite.

OIL PUMP motor connections to conduit are protected from seeping oil by ½-inch Sealtite.



IMMERSION HEATER connections for Storke crusher gyratory lube oil system are protected from heat and spillage by 1-inch Sealtite.



STORKE CRUSHER exhaust fan motor connection in ¾-inch Sealtite must accommodate motor position shifts.

Nearly a mile of Sealtite flexible, liquid-tight conduit protects wiring for Climax Molybdenum*

In hundreds of vital spots, more than 4000 feet of Sealtite help keep equipment operating dependably at The Climax Molybdenum Company mine, Climax, Colo. The flexible, liquid-tight conduit guards wiring to motors and controls from the full range of underground mining and mineral dressing hazards—from rock fragments to flotation reagents, dust, oil, heat, moisture, vibration, and movement.

Electrical Wholesalers stock Sealtite. Buy it in long, random lengths on nonreturnable wooden reels, at no extra cost. Available in sturdy cartons that are easy to store and carry to the job. Liquid-tight connectors also are available from wholesalers' stocks. For information write: The American Brass Company, American Metal Hose Division, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 58185

**A Division of American Metal Climax, Inc.*

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.

insist on the conduit marked **SEALTITE®**

FLEXIBLE, LIQUID-TIGHT CONDUIT

an **ANACONDA®** *product*

FOR BIG POWER use Maxi-Power

PARALLEL SHAFT HELICAL GEAR DRIVES

1. Heavy duty, reinforced design housing for permanent alignment, rigid shaft support.
2. One mesh per reduction—fewer moving parts.
3. Broad faced helical gearing—high quality, accurately hobbed for greater strength, durability. Uniform tooth deflection under load . . . no uneven wear.
4. Shafts firmly held in place. Positive gear location assures full tooth engagement across entire face.
5. Smooth, overlapping mesh, close backlash tolerances, no oil trap, provide quiet operation, less heat generation.
6. Heavy duty, anti-friction bearings. Conservatively rated for wide range of operation.

Capacities to 1550 H.P.

★ Single, Double, Triple Reductions

★ Standard Ratios from 2.08 to 1 up to 360 to 1

★ 9 Shaft Arrangements

There's more capacity, greater stamina and longer service life built into Foote Bros. Maxi-Power Parallel Shaft Drives. Simple, balanced design, fewer moving parts, heavy duty construction, efficient lubrication and conservative ratings make Maxi-Power drives the logical choice for critical applications and severest operating conditions.

You can depend on Maxi-Power Drives to produce maximum performance with minimum attention because they're built for just that kind of service.

Write for Engineering Manual MPB—has complete details and selection data. There's no obligation.

this trademark stands for the finest industrial gearing made

FOOTE BROS. Cut-Rite LIFETIME GEARING

T. M. REG. U. S. PAT. OFF.

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION

4553 South Western Boulevard Chicago 9, Illinois

Utah *(Continued)*

relatively high grade ore in the Big Indian district.

The firm, according to Standard president W. R. McCormick, Moab, already has delineated more than $1-million worth of ore in place on the Col-U-Mex Uranium Co. claims, 1,600 ft southwest of the present Standard, Big Buck mine. The Col-U-Mex development is a joint Standard-Col-U-Mex venture, connected to Standard's workings by a 1,600 ft rail haulage tunnel.

In the process of developing this orebody, Standard has found that the ore extends onto the south end of its Big Buck claims.

While this latter ore area has not been developed, it has a 14 ft width, Mr. McCormick said.

In the course of the last 12 month's joint venture, Standard has paid off all mining development costs, and is now splitting profits from mining 50-50 with Col-U-Mex.

Shipments of ore, running between 0.38 and 0.44% U_3O_8, are being made at rate of 150 tpd to the Uranium Reduction Co. mill at Moab.

The reason for the somewhat small shipment rate is the fact that Standard made room in its quota from URC for the Col-U-Mex shipments. Standard continues to ship from its present properties and does not intend development of the new ore area on south end of the Big Buck until needed.

Mr. McCormick said that some chemical assays of the Col-U-Mex orebody run as high as 0.90% U_3O_8.

Industrial Uranium Corp. hopes to obtain better prices for its ore through a process of selective shipping.

Robert M. Schubach, Salt Lake City, president of the closely held firm with properties in the Monument Valley area of northern Arizona, said the plan was evolved as a result of varying payments for copper and vanadium contained in ores as well as market for different grades of carnotite ores produced at four properties.

Procedure is to stockpile the various ores and then ship them. Despite the extra handling charges involved, the firm believes procedure will pay.

Mr. Schubach said that the only mills expressing interest in paying for vanadium in ores within shipping range of Industrial's mines were Vanadium Corp. of America at Durango and Union Carbide Nuclear, at Rifle, Colo.

While Texas-Zinc Minerals Corp. at Mexican Hat, San Juan County, Utah, is making some payment for copper, it makes no payment for vanadium. Neither does the Rare Metals Corp. of America mill at Tuba City pay for vanadium.

However, Rare Metals is able to take somewhat lower valued uranium ores in limited quantities.

Industrial has been getting about $5 a ton V_2O_5 values for better ores. It hopes to get around the copper problem by erection of a simple "hydraulic, sand-slime separation" mill in which these values can be removed. The only prominent copper is in the firm's Sunlight mine, running about 2.75 to 4.65% Cu.

Utah *(Continued)*

The Galigher Co., Salt Lake engineering and research organization, is conducting experimental work on the copper recovery, Mr. Schubach said.

The Salt Laker also announced that the north end of the Moonlight mine is being converted to an open pit by Wells Cargo, Inc., Las Vegas and Reno, Nev., mine contractors.

Wells Cargo will remove some 600,000 tons of overburden, create a 150 ft deep pit with a ten to one stripping ratio. This company, which has just started work on the pit, will also mine and selectively stockpile ore from this property.

WASHINGTON

Shaft mining operations in the Mount Spokane district have been started by Bear Creek Uranium Co. The company has sunk a 7x9 ft shaft to a depth of more than 90 ft into an ore body.

Oscar Herem, of Miles City, Mont., supervisor of the operation, said the ore body, reached at a depth of 83 ft, occurs in a faulted zone of altered granite.

Working with Herem on the job are E. M. Conover and W. C. Pederson, Spokane mining contractors. Some of the ore contains greenish autunite crystals, officials said. More than 70 tons of ore have been stockpiled at the site. Shaft sinking operations are moving ahead at the rate of about 2 ft a day.

Daybreak Uranium, Inc., Spokane, said that it plans to resume underground development work in the Mount Spokane area and exploratory drilling in the Spokane Indian reservation mining area.

Kae H. Sowers, secretary of the firm, said the underground work would be started at the Dahl lease. Underground work was begun last March and was later suspended after tunneling was extended 100 ft, and a one-ton ore shipment was made.

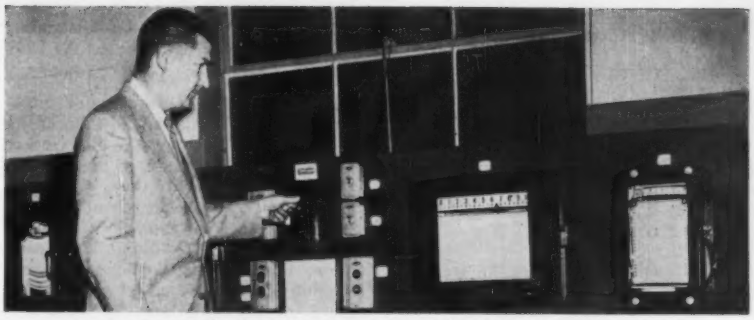
Daybreak plans to start the second phase of a $29,476 drilling project, approved by the Defense Minerals Exploration Administration, at the Lowley lease on the Spokane Indian reservation. Earlier work consisted of 15 holes drilled up to depths of 180 ft. Officials reported that one of these holes penetrated ore which assayed at 0.32% U_3O_8 and another hole showed 0.155% ore. The new drilling program will extend to depths of 390 ft.

WYOMING

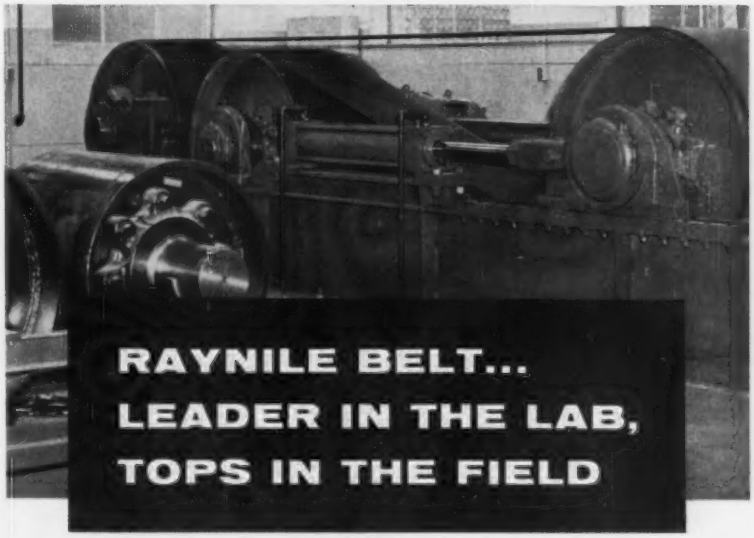
Shoni Uranium Co., Riverton, is looking toward shipment of uranium ore at rate of 2,000 tons a month from its recently-opened Bonanza mine, according to Shoni president Vern Hughes.

The open cut mine is expected to supply some 15 months of shipping material from stripping operations presently being completed.

"The time of resumption of mining in 1959 would be dependent in part on



50,000 lb. thrust load torture test for Raynile splice.



The first Raynile Belt installed by Hewitt-Robins in 1948 is still in service, with a record of extreme ruggedness; exceptional resistance to ripping and to impact; and improved troughing and training. This is good reason why these Hewitt-Robins conveyor belts have become the FAMOUS NAMES ON THE BIG JOBS EVERYWHERE for handling all kinds of bulk materials:

RAYNILE; for operating tensions of 90 to 130 lbs. per inch per ply.

SUPER RAYNILE; for operating tensions of 150 to 200 lbs. per inch per ply, improved with miracle fabric to do jobs previously thought impossible.

RAYNILE SUPREME; with miracle fiber for tensions over 200 lbs., stronger and more flexible than steel.

Let the many years of Hewitt-Robins experience, engineering, and research in developing the best in conveyor belting benefit your operation. To find out how H-R products and services can help you, consult your classified telephone directory for the nearest H-R representative, or contact Hewitt-Robins, Stamford, Connecticut.

HR HEWITT-ROBINS

CONVEYOR BELTING AND IDLERS . . . POWER TRANSMISSION DRIVES
INDUSTRIAL HOSE . . . VIBRATING CONVEYORS, SCREENS & SHAKEOUTS

H-R Product Manufacturing Plants in Buffalo, N.Y. • Chicago, Ill. • King of Prussia, Pa. • Passaic, N.J. Amsterdam, Holland • Johannesburg, South Africa • London, England • Montreal, Canada • Paris, France

Wyoming (*Continued*)

the rate of sales," Mr. Hughes said. Exploration drilling will be conducted during the 1958-59 winter months, he added.

Vitro Corp. of America reported a net profit of $276,254 for the first six months of 1958 after taxes. This compared with a net profit of $774,333 for a similar period of 1957.

Total revenue of $33,404,985 was an increase of $3,281,546 over the corresponding period of last year.

The computed net profit was equivalent to 23c per share on the outstanding stock as compared with 80c for the 1957 period.

The Wyoming Farm Bureau Federation has proposed legislation to allocate a percentage of the tax of the current surface assessed valuation to mineral and oil rights.

Farm Bureau leaders said a bill embodying this proposal will be submitted to the 1959 Wyoming legislature.

The Farm Bureau pointed out that Wyoming has no tax on oil and mineral rights unless there is actually some production. It proposed that holders of oil and mineral rights pay a share of the ad valorem taxes now paid by the surface right holder.

The powerful farm organization said it did not propose to increase property taxes, but rather divide the present tax between surface and mineral holders.

FLASH!
A newly developed Bemis explosives bag is now being tested. The bag has kept contents perfectly dry even though submerged in a mine pond for days. Write or wire for details.

Packer-Ette at United Electric Coal Company's Fidelity Mine packing Bemis-made waterproof (laminated) bags. Packer-Ette is equally efficient in packing polyethylene bags or tin cans.

Bemis Packer-Ette

Packs Ammonium Nitrate Explosive With Greater Speed, Economy, Accuracy, Cleanliness

- **50 percent increase in production**
- **Two-man operation, instead of three**
- **Accuracy to 3 ounces on a 33-lb. bag**
- **Instant adaptability for packing waterproof (laminated) bags, polyethylene bags, or tin cans**
- **Complete cleanliness**

These five major benefits were reported by United Electric Coal Company when it began packing its formulation of ammonium nitrate explosive on a Bemis Packer-Ette bag packing machine.

The Packer-Ette maintains a steady production of six bags or cans per minute, with no delays for hand-tamping or cleaning up overflow (there is no overflow with Packer-Ette), and no guesswork on weights.

Write or phone us for *complete* information about this new, efficient, and economical method of packing ammonium nitrate explosives.

General Offices—
408 Pine Street, St. Louis 2
Sales Offices in Principal Cities

Bemis

IN CANADA

QUEBEC

Over 40 occurrences of radioactive minerals containing uranium or thorium are described in a geological report just released by the Department of Mines for the Province of Quebec.

The report (G.R. 80), entitled "Radioactive Mineral Occurrences of the Province of Quebec," gives the results of an investigation carried out by D. M. Shaw for the Mineral Deposits Branch.

Another report (G.R. 79), issued at the same time, deals with the Bignell area in the Chibougamau district. Evidence of mineralization is widespread throughout the examined area.

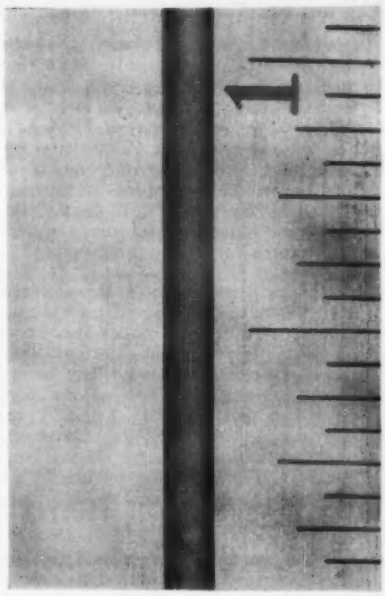
Copies of both reports are available from the Department of Mines, Parliament Buildings, Quebec, Canada.

L. J. Severson, president of Quebec Cartier Mining Co., wholly-owned U. S. Steel subsidiary, has announced that a contract to build a 193-mile railroad alongside the access road from Port Cartier to Lac Jeannine, Saguenay County, has been awarded to a joint venture composed of C. A. Pitts of Canada Ltd. and Foley Brothers of Canada Ltd.

Mr. Severson also announced awarding a general construction contract in connection with a 60,000-hp hydroelectric plant on the Hart-Jaune River, a tributary of the Manicouagan River in the St. Lawrence watershed, to the Foundation Company of Canada Ltd.

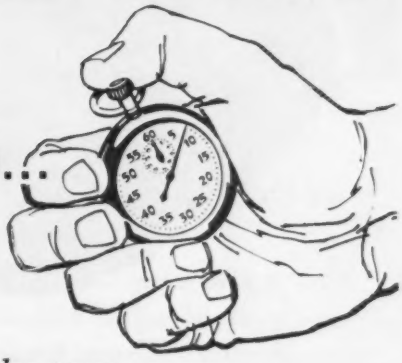
Production at Opemiska Copper Mines in the Chibougamau area showed a considerable increase in the second quarter of this year. Average milling rate was boosted by 152 tpd to 965 tpd. Rate in June averaged 1,012 tpd. During the quarter, 87,780 tons were milled for output of 6,135,655 lb Cu, 2,430 oz Au and 38,850 oz Ag, having total value of $1,584,588. In the previous quarter, tonnage milled amounted to 73,207 tons for production of 5,341,360 lb Cu, 2,155 oz Au and 31,430 oz Ag valued at $1,221,490.

The Malartic area gold property of Norlartic Mines, dormant for many years, is to be brought into production. Underground diamond drilling is under way to confirm and if possible, to enlarge ore reserves. The work is being carried out under the wing of Malartic Gold Fields, a nearby gold producer. The latter will treat the Norlartic ore at its mill. Available ore, based on previous work, has been calculated at 367,950 tons grading 0.155 oz Au per ton. There is a shaft on the property to 540 ft depth with four levels established.



Measure the build-up height...

Clock the deposition rate...



Check all the welding features of the new

STOODY IRON POWDER BUILD-UP ELECTRODE!

Here's a better answer to today's build-up requirements on parts of carbon and low alloy steels. Stoody Iron Powder Build-Up makes tough, rigid deposits of high compressive strength, insuring ample support for hard-facing overlays. Deposits are forgeable, resistant to cold flow and deformation, won't spall, work-harden or crack. Deposits are also machineable with preheat, will not exceed 45 Rc in hardness even when severely quenched.

Unlike most build-up materials, *Stoody Iron Powder Build-Up does not depend upon carbon to develop hardness!* Its high alloy content produces a more uniform Rockwell hardness despite wide variations in base metal analysis.

Here's a better, more dependable, general purpose build-up electrode that puts down more metal in a single pass, welds with less spatter and lays down more pounds per hour at a lower cost per pound! Order Stoody Iron Powder Build-Up from your Stoody Dealer today. Check the Yellow Pages of your phone book or write direct.

Literature available

STOODY COMPANY

11930 East Slauson Avenue · Whittier, California

WE'VE SET OUR TEETH *for the job...*

Whether its coarse, fine grain, solid or broken formation EVERY diamond drill bit designed by J. K. Smit has behind it, hundreds of miles of actual field drilling tests.

EVERY diamond is of uniform size, shape and structure throughout; hand picked from thousands with a skill born of 68 years in this highly specialized business.

This means LOWEST footage costs, LONGEST bit life, and HIGHEST SALVAGE.

J. K. Smit's service and experience in manufacturing and using Diamond Drill Bits is as available to you as your telephone.

Call your nearest field representative, or send for our latest Diamond Drill Bit Catalog #57

BIT BY BIT, THE BEST IS SMIT

J. K. SMIT & SONS, INC.
HOME OFFICE AND PLANT
MURRAY HILL NEW JERSEY
TORONTO, ONTARIO, CANADA

Quebec *(Continued)*

Quebec Cartier has awarded contracts for a 193-mile railway and a 60,000 hp hydroelectric development as a first step in production plans for its large iron project in the Mt Wright-Mt Reed area. The mine is said to be Canada's largest with plans calling for the mining of 60,000 tpd. The operation is being financed by the parent, U.S. Steel Corp. Expenditures are expected to run around $300-million to bring the mine in.

Encouraging results are being obtained in a diamond drilling program being carried out jointly by Barnat Mines and Canadian Malartic Gold Mines on their common boundary. The drilling is designed to seek repetition of the porphyry-type gold orebody found in recent months on the Barnat property. At the same time Barnat Mines continues to round out the picture of its new orebody from the 725- and 900-ft levels.

Sparked by major base metals find by the Mattagami Syndicate and copper discoveries by New Hosco Mines and Kennco Explorations, the Mattagami area has become one of the most active areas in Canada in recent years. The activity has splashed out over an area of more than 2,000 sq miles. Scores of companies have moved into the area and detailed field programs are scattered all over the district.

First results in the area were obtained by the Mattagami Syndicate last year. Diamond drilling indicated some 14-million tons averaging 13.5% Zn, 0.65% Cu, 1.11 oz Ag and 0.016 oz Au per ton. The second major discovery occurred this summer when New Hosco located a new copper deposit, extent of which is yet to be determined. This was followed by another new discovery by Kennco Explorations, a wholly-owned subsidiary of Kennecott Copper Corp.

The number of big companies engaged in the area is impressive. These include Noranda Mines, International Nickel Co., Newmont Mining Corp., Rio Tinto Canadian Exploration, Dome Mines, Camp Bird, Selco Exploration, Phelps Dodge, and Billiton Co.

The Department of Mines of the Province of Quebec has issued a report (P.R. No. 371) on the lead and zinc deposits in the Province. The report describes briefly the location and main features of about 300 occurrences of lead and zinc distributed throughout the Province.

Another report (P.R. 359) issued at the same time deals with the St. Sylvestre-St. Joseph (West Half) areas, about 35 miles south of Quebec City. Several companies have worked some of the serpentine bodies for asbestos. A number of copper deposits were mined during the 19th and early part of the 20th centuries. In 1956, new development work was carried out on the old Harvey Hill mine in Leeds township.

Copies of these reports, accompanied by a geological map in the case of P.R. 359, may be obtained from the Department of Mines, Parliament Buildings, Quebec City, P.Q., Canada.

Quebec (*Continued*)

Weedon Pyrite & Copper Corp. Ltd. reports that two diamond drill holes put down from the south end of the 1501 north drift on the 15th level have cut copper values which possibly indicate the downward extension of the ore section encountered last year in cutting the 15th level station.

The first of the two new holes, drilled 75 deg down, cut 3.17% Cu from 99.4 to 102.3 ft, and 0.75% Cu from 102.3 to 108.7 ft. The second hole, drilled 73 deg down and 45 deg left of the first hole, returned 2.09% Cu from 65.0 to 68.5 ft, and 5.55% Cu from 88.0 to 101.7 ft.

The drilling was done to help clear up the geology on the 16th level before drifting at that horizon commences. The No. 4 shaft has been stopped temporarily in order to get this drifting under way.

BRITISH COLUMBIA

Japanese ore carriers are taking record cargoes of iron ore from British Columbia mines following the Supreme Court ruling last month of illegality of B.C. Mineral Properties Taxation Act, which, together with a subsequent order-in-council, discouraged iron ore export to Japan.

The Terukuni Line's *SS Nitta Maru* loaded 16,702 tons at Texada Mines on Texada Island, and the new *MS Nichizui Maru* of the Nissan Line loaded an equally big cargo of Qualicum ore at Port McNeil.

Inland Natural Gas Co. has contracted to supply 5-million cubic ft of natural gas per day to the Trail (British Columbia) smelter of Consolidated Mining & Smelting Co. of Canada. Under the contract, Inland has agreed to make available up to 8-million cubic ft per day. It is expected that this upper limit will be reached within the next two years.

Conversion of Cominco's facilities to use natural gas is under way and a substantial part of the 5-million cubic ft will be on stream by late autumn.

In a statement from Vancouver, Inland president McMahon said the contract may be the start of a much larger use of natural gas by Cominco (the largest producer of lead and zinc in Canada) within the next few years. At the time of Inland's financing it was estimated Inland would sell to Cominco about 2.5-million cubic ft per day, or one-half of the present amount called for by the contract.

Canadium Radium Corp. reports possibilities of new high-grade silver orebody have been raised at its Horn silver property in the Similkameen district following the results of the latest diamond drill hole. Hole No. 4 encountered a 7-ft section of well-mineralized quartz with heavy sulphides and showings of native silver.

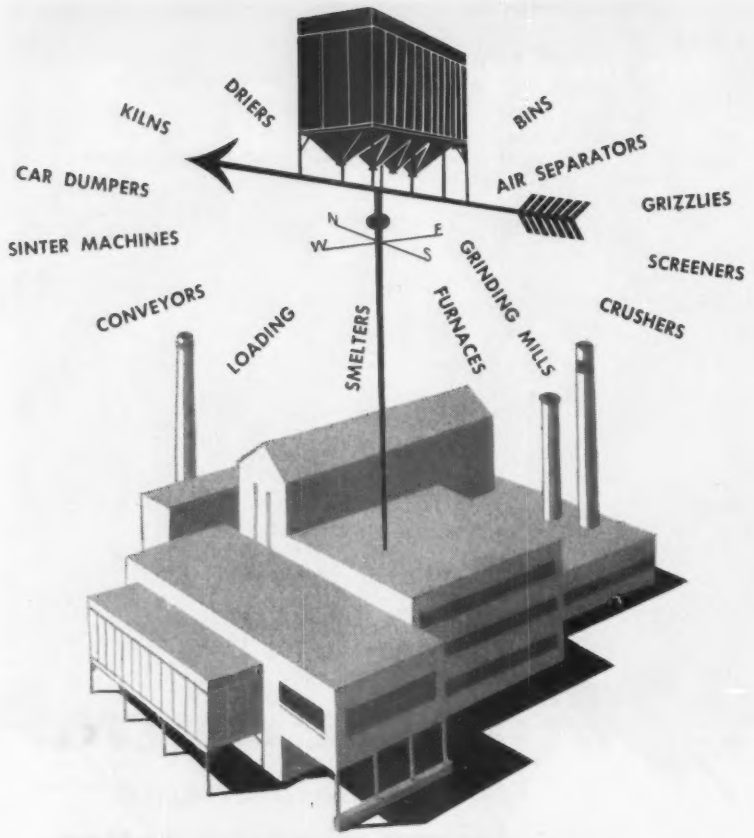
Magnum Copper Ltd. and Centennial Mines Ltd. report they have jointly taken an option to purchase the Hank group of mineral claims in the Merritt

ANACONDA
solves maintenance by car standardization

Over 15 years ago, The Anaconda Company came to Card seeking the engineering of a side dump ore car that could serve a wide scattering of mine properties in Montana. Design requirements submitted by Anaconda called for long life in underground heavy-duty haulage and highly corrosive conditions.

About 1200 Card Granby-type cars are now in service in Anaconda's Montana operations. The latest designs differ in minor aspects from the original order, but all have proved highly satisfactory. The 115 cu. ft. car on 36" gauge has a high capacity to length ratio, keeping trains short. For maximum capacity, doors and back are internally braced. To ease loading shocks, the trucks are coil spring mounted, and the use of Card heat treated cast steel wheels with Timken bearings assure extended wheel life and easy haulage. Card engineers are happy to consult on any haulage problem. No obligation.

C.S. Card Iron Works Co.
2501 WEST 16TH AVE.
DENVER, COLORADO



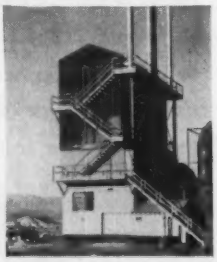
Everywhere you turn

in the mining and metallurgy industry

WHEELABRATOR® DUSTUBE® COLLECTORS

are turning problems into profits

Dust need no longer be a problem . . . but can be turned into profits throughout the Mining and Metallurgy Industry. Valuable by-products are salvaged from furnaces, sintering machines, driers, kilns and other equipment by the use of Wheelabrator Dustube Collectors. Highest efficiency plus lowest operating cost offers you recoverable dollars instead of recurring doubts. Dustube's simple cloth tube design provides the most dependable method of dust removal and recovery known. It has the inherent capacity for continuous, severe service, with a minimum of downtime.



Wheelabrator Collectors are particularly suited for the recovery of materials in hot gases. Through the use of synthetic filtration fabrics, including glass, orlon and dacron, they are readily applicable to severe heat applications. Dustube collectors are available as standard units or individually designed for your particular problem.

For information, Ask for Bulletin 372-D.

50 YEARS OF PROGRESS
WHERE PIONEERING LEADERSHIP INSURES PERFORMANCE

WHEELABRATOR
CORPORATION

438 South Byrkit Street **Mishawaka, Indiana**
Canadian Offices: Scarborough (Toronto) – Montreal

British Columbia *(Continued)*

area from William Taylor and associates. The group consists of about 36 claims on which a magnetic anomaly 1,200 ft by 200 ft has been outlined. A work program has begun under direction of Canadian Exploration Ltd.

Blue Star Mines Ltd. has let a contract for the driving of 50 ft of crosscut and extension of the Matheson tunnel on its Wellington mine property at Retallack. The crosscut is projected to intersect the Wellington north and south veins at a vertical depth of 200 ft below the 200-level adit.

Western Nickel Ltd., which had reactivated operations of the old Pacific Nickel Co. property near Hope has announced immediate closure of the operation "due to modification and partial cancellation of its European metal sales contract." Resumption of the operations will depend on finding other markets for the firm's nickel concentrates.

An immediate magnetometer survey has been recommended on the 32 claims recently acquired by Alscope Explorations Ltd. near Merritt. Consulting engineer Henry L. Hill & Associates report the properties are underlain by andesite and limestone. The regional geology and the widespread copper mineralization that occurs in the area is very favorable, according to Hill.

Complete Line Of

DREDGES and DREDGING EQUIPMENT FOR MINING

- *Hydraulic*
- *Bucket Line (Placer)*
- *Dipper*
- *Grapple*

Plus detailed engineering service . . . write for full information.

ELLICOTT MACHINE CORPORATION
1633 Bush Street, Baltimore 30, Md.
525 Market Street, San Francisco 5, Calif.

ELLICOTT

Subsidiaries: Dragues Ellicott France, Paris, France; Ellicott de Mexico, Mexico City, Mex.; Ellicott Fabricators, Inc., Baltimore, Md.; McConway & Torley Corp., Pittsburgh, Pa.; Baltimore Foundry & Machine Corp., Baltimore, Md.

Successors to the floating dredge business of the Bucyrus-Erie Co. and the American Steel Dredge Co. Complete engineering sales and repair parts service. 1144

British Columbia *(Continued)*

Bralorne Mines' 33rd level (averaging an ounce gold over 8 ft) may be its best producer, topping the 32nd level (averaging 1.15 oz over 7.3 ft), up to now the richest orebody in the mine. The 33rd level is not as high grade as the 32nd but the ore is longer and wider.

Giant Mascot Mines Ltd. has started production in Canada's first flotation barite plant from tailings at its exhausted Spillimacheen lead mine, which was shut down for June, 1957, when it ran out of lead. Present 50 tpd production will run into 100 tpd in September. Giant's plant is said to be unique in the metallurgical field. Company officials claim that it is the only operation on this continent to recover barite from mine tailings. Entire production has been contracted to McPhail Engineering of Tacoma, who will dry, size, bag and market it.

Rexspar Uranium Metals Mining reports good progress at its Birch Island property near Kamloops. The foundations for the grinding plant have been completed and construction of the administration and warehouse buildings is under way.

Magnum Copper Ltd. reports drilling results from six drillholes on its copper claims at Mile 408 Alaska Highway assayed from 2.15% to 8.5% Cu. Average grade was 6.21% Cu over an average 9.8 ft width.

The SCHOOL That Comes To YOU

- **If you are on foreign assignment**
- **If you live in an isolated area**

Wherever you are, Calvert SCHOOL-AT-HOME Courses can provide, by mail, a modern education for your child. Kindergarten through 8th grade. Courses stress the three R's, science, and cultural subjects. They are kept up to date by continuous pretesting in Calvert's famous laboratory-school in Baltimore. Parents with no teaching experience are supplied with complete step-by-step instructions. Start any time, transfer easily to American schools. More than 100,000 children all over the world have used Calvert Courses. 53rd year. Non-profit. Catalog (give age, grade).

960 Tuscany Road, Baltimore 10, Md.

CALVERT SCHOOL

inspection...

is this your wire rope problem?

Safety and economy can be greatly improved by methods described in LESCHEN RED-STRAND BULLETIN NO. 104

Without adequate inspection, a severely damaged rope might remain in service until sudden failure and thus bring disaster. Such danger will be foreseen and adequate safety measures adopted in plenty of time, however, wherever a well organized program of periodical inspections is maintained. Bulletin No. 104 gives detailed instructions for setting up and maintaining such a program, tells what to look for and what findings mean. Copies sent free on request. Write to H. K. Porter Company, Inc., Leschen Wire Rope Division, St. Louis 12, Mo.

LESCHEN Red-Strand WIRE ROPE

H. K. PORTER COMPANY, INC.

LESCHEN WIRE ROPE DIVISION

YOU **SUMP** IT!

WE **PUMP** IT!

The Galigher Company's vast experience in pumping and their knowledge of abrasion and corrosion proofing has enabled them to solve serious material handling problems.

U.S. PATENT NO. 2,808,782

PROBLEM:

To handle a corrosive slurry containing phosphoric acid, sulfuric acid, kerosene, amines and chlorides in the solvent extraction process at uranium ore concentration mills.

SOLUTION:

Acidproofiing the Galigher Sump Pump with a protective coat of POLYVINYL CHLORIDE (PVC).

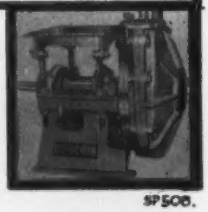
RESULTS: Outstanding success under these extreme conditions resulted in a completely satisfactory pumping operation. Therefore, similar Galigher Sump Pumps have been specified for use in other uranium mills.

Galigher Sump Pumps are also available in the following materials of construction:

- Rubber Covered
- Neoprene Covered
- Hypalon Covered
- Hard Iron
- Stainless Steel
- Ni-Hard

THE VACSEAL PUMP

Precision engineered for rugged use. Exclusive impeller-design eliminates gland water.



SP500.

BULLETINS ON REQUEST **Distributors in Industrial centers of U.S. and Foreign Countries.**

GALIGHER

CONSULTATION · ORE TESTING · PLANT DESIGN

Leaders in Experience and Service

METALLURGICAL DIVISION . . . ENGINEERING SERVICE

GALIGHER PRODUCTS: AGITAIR® Flotation Machine, VACSEAL Pump, Geary-Jennings Sampler, Acid-proof Sump Pump, Geary Reagent Feeder, Laboratory AGITAIR® Flotation Machine, Laboratory Pressure Filter, Laboratory Ball Mill, Rubber Lined and Covered Products, Plastic Fabrication.

The GALIGHER Co.

HOME OFFICE: 545-585 W. 8th South, P. O. Box 209, Salt Lake City 10, Utah
EASTERN OFFICE: 921 Bergen Ave. (Room 1128), Jersey City 6, New Jersey

British Columbia *(Continued)*

Western Mines reports Consolidated Mining & Smelting has terminated its agreement to develop Western's lead-zinc-silver property at Ainsworth. Cominco spent more than $150,000 on development work and concluded that rather than a very large tonnage of medium grade ore, the property had a lesser tonnage of higher grade ore.

Cellador Mines Ltd. plans 1,000 ft of diamond drilling on its Vancouver Island property. Some known ore occurrences have already been mapped, and power and transportation are immediately available. Little construction is required, according to the company, which is proposing a $15,000 exploration program.

Aluminium Ltd. recently stated that one of its trading subsidiaries has concluded a new contract in Oslo, Norway, with the largest Norwegian aluminum producer, calling for the delivery during the next 20 years of a total quantity of about 4.4-million short tons of alumina.

It is expected that the major portion of the alumina will be supplied by Aluminium Ltd.'s producing company in Jamaica, West Indies. Actual payment for the alumina will be made in aluminum metal which Aluminium expects to sell mainly in sterling areas.

The other contracting party is A/S Aardal og Sunndal Verk, whose productive capacity of 75,000 tons of primary aluminum per annum in 1957 is being expanded to more than 125,000 tons by 1961.

SASKATCHEWAN

Construction started this week on the first leg of a 525-mile all-weather road from railhead near Prince Albert, in northern Saskatchewan, to Uranium City, headquarters for uranium ore production by seven mining companies off Lake Athabaska in the far northwest corner of the Province.

Cost of the $16-million road is being shared 50-50 by the Provincial and the Federal governments. Construction this year is taking place from the south end only but next spring, and for the succeeding four years, it is expected to take to complete the road. Construction will proceed from both ends.

Route to be taken by the road will cut through chalcopyrite formations and base metal exploration areas in the vicinity of Waden Bay, northeast of Prince Albert. Expectation is also that it will proceed directly north to touch uranium and base metal claims and exploration areas near Stony Rapids, then swing toward Uranium City.

Saskatchewan Resources Minister A. G. Kusiak said one main purpose of the road is to place the uranium properties in the vicinity of Uranium City in a better competitive position. Operating companies at present are mining and processing under contracts for assured deliveries and set prices with Eldorado Mining & Refining Co. Ltd. Ore is relatively high grade, which helps offset the high cost of bring-

FIELD REPORTS PROVE SUPERIOR PERFORMANCE OF NEW BOSTON BELTS

DIGEST OF PERFORMANCE FIGURES FOR 1296 BELTS*

44% increase in consistency of tensile strength

6% increase in tensile strength

130% improvement in consistency of elongation

* Compared to belts previously manufactured

HERE'S WHAT DOES IT!

The startling figures above are a direct result of two major belt manufacturing advancements — both developed by, and exclusive with, Boston Woven Hose & Rubber Co.

ADVANCEMENT #1 **BALANCED BELT CONSTRUCTION** for the first time equalizes ply stress so that each ply pulls its full share of the load. **BBC** eliminates lazy plies. A BOSTON exclusive because only BOSTON can combine Electronic Tension Controls with Rotocure, the continuous method of vulcanization, which assures uniformity throughout the belt.

ADVANCEMENT #2 **DULON** markedly improves the aging characteristics of BOSTON belts. An exclusive BOSTON research development, the tough specially treated cover compound stays resilient longer . . . makes the belt much more resistant to abrasion, gouging, tearing and oxidation.

BALANCED BELT CONSTRUCTION plus **DULON** add up to longer belt life . . . less trouble in service . . . greater economy.

BOSTON

BOSTON WOVEN HOSE & RUBBER COMPANY
DIV. OF AMERICAN BILTRITE RUBBER CO., INC.
BOSTON 3, MASS.

Saskatchewan *(Continued)*

ing in all fuel oil and equipment via summer barge. Lower grade properties are, however, difficult to bring into production, now and in the immediate future, Kusiak said. The area possesses substantial proven reserves but these could not be exploited until costs were brought down.

A second road being built under the "Roads to Resources" program of Federal subsidies to provinces introduced by Federal Northern Affairs Minister Alvin Hamilton, is well along the first leg of construction. It is the 212-mile long all-weather stretch running east from Prince Albert to the mining city of Flin Flon on the Saskatchewan-Manitoba boundary. Estimated cost of this road is $3.5-million, and two and one-half years are scheduled for construction. The road will open up a large new mineral area (mainly base metals with some gold and silver) along the southern edge of the Precambrian shield.

ONTARIO

Milliken Lake Uranium Mines Ltd. announced that its 3,000 tpd mining property in Algoma is now up to full tonnage with output for August averaging 3,240 tpd. During July, 88,179 tons were treated, averaging 2,844 tpd and yielded a gross production of $1,457,000. According to the company, the mill has operated satisfactorily and achieves an average recovery of 93.25%. With development work gradually running ahead of production, Milliken is now getting into a position where selection of ore for grade control can be exercised.

Under the management of the Rio Tinto Mining Co. of Canada Ltd., Milliken Lake holds a contract for the sale of $94,525,000 worth of uranium oxide to Eldorado Mining & Refining Ltd., Canadian government buying agency.

Cordoba Mines is carrying out an extensive exploration program on its 123-claim gold prospect in Balmer Twp, Red Lake area. Gold and base metal values have been encountered in drilling and surface work. In the northern portion of the property, an interesting gold discovery has been made and further work is currently in progress. Geophysical surveys have indicated a number of anomalous areas in another sector on which limited diamond drilling has given encouraging results.

Norpax Nickel Mines has started surface diamond drilling on its original gold prospect in the Pickle Lake area. Some diamond drilling was completed many years ago. Deepest probe at that time was to a depth of 470 ft. Current drilling is designed to test a shear zone at greater depth.

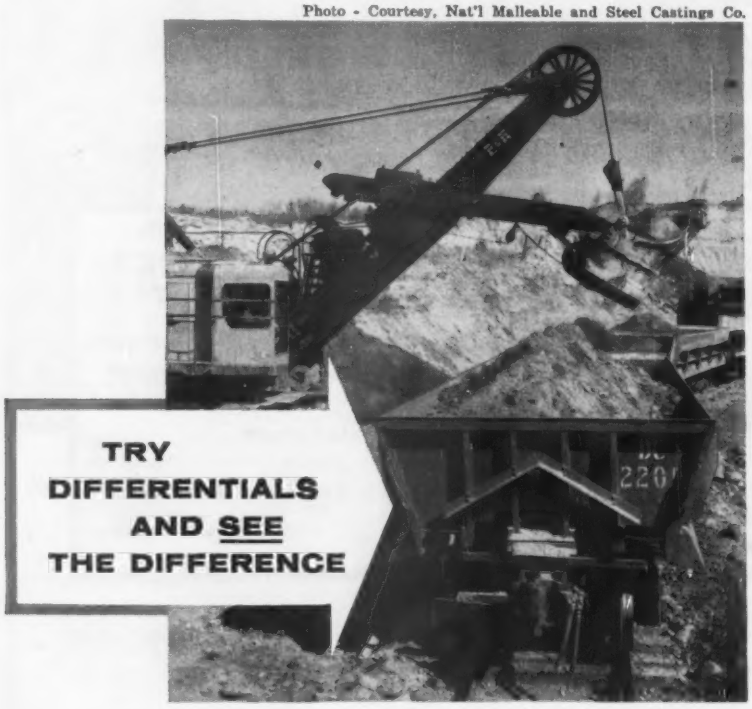
Cochenour Willans Gold Mines has agreed to spend a minimum of $350,000 in an underground test of the adjoining Martin-McNeely Mines property in Dome Twp, Red Lake area. The 19-claim Martin group will be turned over to a new company in which Cochenour will eventually have controlling interest. The present program calls for a 4,400 ft drive from Cochenour's new 1,200 ft level, plus extensive underground diamond drilling. The first objective will be an area where gold ore values were obtained in earlier drilling by Martin.

Milliken Uranium Mines has pushed its milling rate to above capacity in short order at its uranium producing mine in the Elliot Lake camp. The mill is now treating over 3,000 tpd. July production topped $1.4-million on an average grade of 1.73 lb U_3O_8 per ton. Mill feed is being drawn from three levels, while development work is in progress to open a fourth level.

H. G. Young Mines is embarking on a major underground exploration program on its Red Lake area gold property in Balmer Twp. Plans include the sinking of a shaft to minimum depth of 750 ft following which drifting is to be carried out on several levels to explore and develop several drill indicated ore zones and other promising areas. Immediate objective will be the A zone on which previous drilling was carried to depths of 300 to 500 ft. This work indicated an oreshoot 500 ft long, grading 0.33 oz gold across five ft.

Faraday Uranium Mines has been setting production records during the past

Photo - Courtesy, Nat'l Malleable and Steel Castings Co.



It takes a tough car to take it away, day after day. The many tons of heavy iron ore that fall relentlessly from the shovel demand a car that can take it.

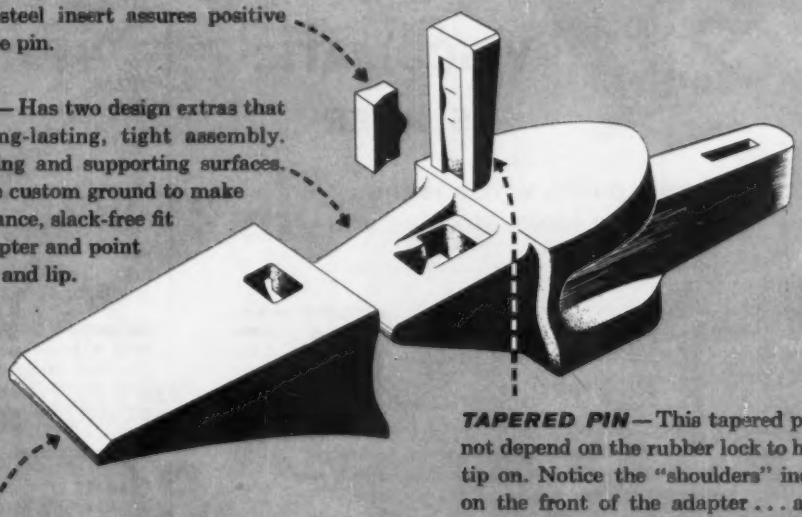
Differential side dump cars — air powered — have been serving the industry for some decades, now, and their performance brings back steady repeat orders that speak for themselves.

Let us send you complete specifications and discuss your needs at your convenience. You'll like what you hear about Differentials.

PIONEERS IN HAULAGE EQUIPMENT SINCE 1915

DIFFERENTIAL STEEL CAR COMPANY
FINDLAY, OHIO

NEW AMSCO® 2 PART TOOTH



PIN LOCK—Special high-strength rubber with a steel insert assures positive locking of the pin.

ADAPTER—Has two design extras that assure a long-lasting, tight assembly. Larger bearing and supporting surfaces. Adapters are custom ground to make a close-tolerance, slack-free fit between adapter and point and adapter and lip.

REVERSIBLE TIP—Enables you to get longer digging life while maintaining sharpness.

TAPERED PIN—This tapered pin does not depend on the rubber lock to hold the tip on. Notice the "shoulders" indicated on the front of the adapter . . . and the mating shoulders on the pin. These shoulders lock the tip in place with metal-to-metal contact. The rubber lock, in turn, locks the pin in place.

3 big features for fewer shovel shutdowns

1 You get up to four times extra wear over other 2-part teeth. We cast these new teeth of a tougher, new and special heat-treated alloy that slashes your replacement and maintenance costs.

2 These reversible teeth stay sharp, to penetrate cleanly and easily without straining your shovel. Reversing point is easy. This reversible feature is particularly important on corner teeth. It maintains digging efficiency throughout tooth life.

3 Positive locking device—Amsco's unique pin-locking design secures tip to adapter in tight, positive, metal-to-metal contact.

Order the Amsco 2-part Simplex from your local power shovel dealer.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS, JOLIETTE, QUEBEC

Slake lime

in a fraction of the time...

with the

VISCOMATIC®

SLAKER

Slakes lime as a paste, which is then diluted and fed as a slurry, to give you—

- **1. Smaller particle size, resulting in *better* slurry for better process control.**
- **2. Substantial savings in lime through more complete slaking.**
- **3. Advantages of using cold water—no heat required.**
- **4. Control of water by viscosity of paste.**
- **5. Simple, trouble-free operation.**

New in conception, design and performance, the "VISCOMATIC" slaker is another example of the ultra-modern equipment that has brought INFILCO leadership in its field. It will help you improve both your processes and your products—save you time, lime and trouble. For complete information write today for Bulletin No. 255.

Special equipment and specialized experience of INFILCO in the Hydrometallurgical field can be interpreted to meet your problems in chemical feeding, leaching, oxidation, carbonating, precipitation and continuous ion exchange. Your inquiry is invited.

INFILCO

Infilco Inc.
General Offices • Tucson, Arizona • P.O. Box 5033
Field Offices throughout the United States and in foreign countries

The ONLY company IMPARTIALLY offering equipment for ALL types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment. 9B512

ALLUVIAL DEPOSITS

Gold-Tin-Columbite-Ilmenite-Bauxite Rare Earths

Most accurately and economically tested for . . . with the

EMPIRE DRILL

NEW YORK ENGINEERING COMPANY

75 West St., N. Y. City, U.S.A. **Cable Address NYECO, N.Y.**

Ontario (*Continued*)

few months at its uranium producing property in the Bancroft area. Output is expected to be stabilized at around $825,000 to $850,000 per month. The mill has been handling about 1,370 tpd with about 140 tons coming from the neighboring Greyhawk Uranium Mines' property. Steady improvement is being made in the ore picture with further development under way to open additional ore sources. Deepening of the shaft for an additional four levels is being started.

Willroy Mines is obtaining indications of improvement in both grade and width at depth in the No. 3 ore zone at its Manitouwadge area zinc-copper producer. A drill hole put out from the new No. 5 or 500 ft level intersected 48 ft (30 ft true width) averaging 2.41% Cu, 10.67% Zn, and 4.57 oz Ag per ton. Crosscutting is now within reach of this area on the 500 level. Shaft sinking has started to open three new levels below No. 5. Mill rate at the mine is running around 1,000 tpd with production being maintained at record level. The company recently secured contract in the U.S. for sale of all its zinc output at a better price than obtained under previous contract with European interests.

Queenston Gold Mines has come up with a brand new gold showing on its 72-claim property in the Savant Lake area. An average of $19.50 per ton was obtained over width of three ft along a length of 111 ft in preliminary sampling of the principal outcrop.

Capacity milling rate has been achieved by Can-Met Explorations at its Elliot Lake uranium producing property following unforseen delays which hampered operations in the first few months of production. The low grade ore area has now been exhausted and production is being drawn from the main ore zone. Recently, grade has been running at 1.95 to 2.02 lb U_3O_8 per ton, against 1.82 to 1.99 lb in the first few months of operations.

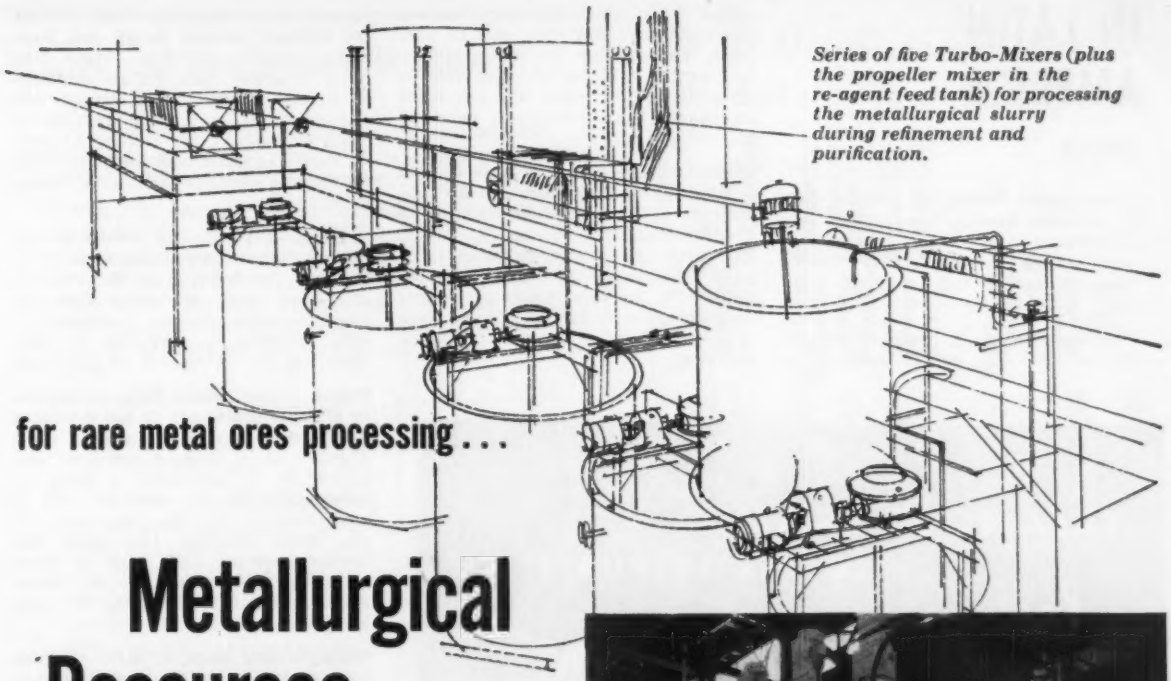
ALBERTA

Interesting new deposits of uranium and molybdenite have been indicated in a 150-square mile area of northeastern Alberta, according to a report of the Research Council of Alberta which encourages further investigation of mineral potential in the area.

Issued in late August, the report was prepared by Dr. John D. Godfrey, head of the Council's mineralogy section, on the basis of geological surveys made by the Council's field parties in 1957-58 as part of a continuing program to determine northeastern Alberta's economic mineral potential.

"This area should be of interest to prospectors and mining exploration companies," stated the report.

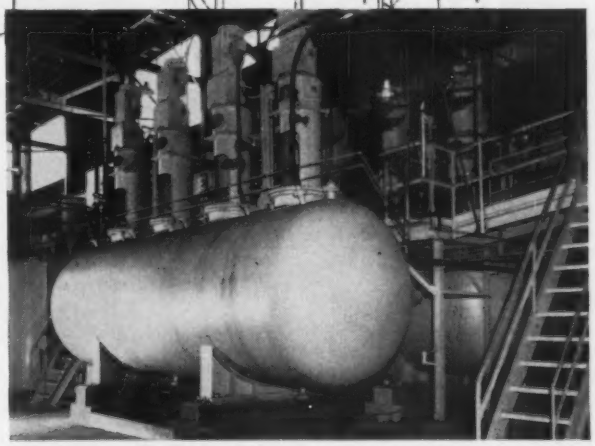
It was emphasized, however, that the Council's studies were of a preliminary nature and that the report should not be considered conclusive evidence that minerals exist in commercial quantity.



Series of five Turbo-Mixers (plus the propeller mixer in the re-agent feed tank) for processing the metallurgical slurry during refinement and purification.

for rare metal ores processing . . .

Metallurgical Resources chooses TURBO-MIXERS



Four-compartment autoclaves for pressure leaching of ore. Each mixer consists of a mixing and aeration assembly to accomplish the contacting of the liquid-solid-gaseous phase system.

There is no easy way to extract rare metals from their ores. Processing plants, such as that of Metallurgical Resources, Inc. of Newburgh, New York, call for skillful design and dependable processing equipment. To help put this new plant "on stream", Turbo-Mixer custom made all of the equipment required.

Turbo's 45 years of experience in design . . . Turbo's record of dependability . . . and Turbo's single-source responsibility make the difference. If you are in the process of selecting or specifying mixing equipment, call on Turbo. You'll find . . . *it pays to plan with General American.*

FOR DETAILED INFORMATION AND USEFUL DESIGN DATA, SEND FOR THE FOLLOWING BULLETINS:

Please send me the following Turbo-Mixer Bulletin (s):

General Turbo-Mixer Bulletin_____

RDC Extraction Column Bulletin_____

Side Entering Propeller Mixer Bulletin_____

Absorption & Oxidation Bulletins_____

TURBO-MIXER DIVISION
GENERAL AMERICAN TRANSPORTATION CORPORATION

Sales offices: 380 Madison Avenue, New York 17, New York • General Offices: 135 South LaSalle Street, Chicago 90, Illinois • Offices in all principal cities

IN LATIN AMERICA

CHILE

Andes Copper Mining Co. finished driving its main haulage tunnel at its new El Salvador mine which is scheduled to start milling by May 1959. The 5-kilometer tunnel was completed without a single serious accident.

Preliminary work is going on at the site of the new copper smelter for central Chile which Empresa Nacional de Fundiciones will build at Las Ventanas, Quintero Bay. The machinery for this smelter will be manufactured by West Germany's Demag and associated companies. The machinery is valued at $5.5-million.

Paulino Callejas and Sons have decided to shut down their copper mine and flotation mill at Farelion Sanchez in Coquimbo province because the present low grade ore cannot be mined at a profit. The same company is going ahead with the construction of another flotation mill at the Quebradita mine near the town of Freirina, Atacama province.

Several heavy snowslides have blocked the railroad between Sewell and Rancagua. Several snowslides have also fallen in Sewell itself but no casualties have been reported. This winter, rain and snowfalls have been particularly heavy in Central Chile, assuring a plentiful supply of water both for milling and for Braden's two hydroelectric power plants.

Stripping is progressing rapidly at the Mantos Blancos copper mine near Antofagastra. Construction of the leaching plant and camp are being done on schedule, and production is expected to start sometime in 1959. The leaching plant will have a capacity of 2,000 tpd.

Paipote copper smelter hopes to increase its blister production to 19,800 short tons during the present year and to reach 22,000 tons in 1959. A new converter is already in operation, a new and faster crane for the converter aisle is being installed and the power plant is also being enlarged. Last June, this smelter produced 2,013 tons of blister which is being refined at the Norddeutsche Affinerie, Hamburg, W. Germany.

Mining Credit Bank, CORFO (Chilean RFC) and Empresa Nacional de Fundiciores (National Smelters Enterprise) have formed a new corporation with the object of mining Chilean radioactive minerals. Company's initial capital will be $150-million.

CUBA

Inter-American Industries, Inc. has built a dam to provide water for its manganese operations in Oriente Province. In addition, the company has erected necessary housing facilities and administrative buildings, installed electric power plants, and built a 35-mile road connecting Cambute with the main highway to Santiago.

Inter-American has 17 mining claims in the Los Negros area, 15 miles west of Cambute, and four claims around El Iris, northeast of Santiago.

Most of the manganese produced comes from underground orebodies, and is extracted by drilling and blasting operations. In some areas, however, where the ore is lodged in nodules, only 12- to 18-ft below the surface, it is removed by bulldozers.

MEXICO

Outgoing President Ruiz Cortines recently gave his final state of the nation speech. A portion of the speech was devoted to the Mexican mining industry, which the President said had been "hampered . . . by the decrease of the international market prices since May 1956, especially in the lead, zinc and copper fields."

To help the industry combat the drop in world prices, the President said his government paid out sums of around $12.5-million during the year ending

TRIANGLE BRAND
COPPER SULPHATE
for
FLOTATION
For more than fifty years TRIANGLE BRAND COPPER SULPHATE has been the accepted activator for the removal of sphalerite from lead-zinc ores. It is 99% + pure and available in several sizes to meet your requirements.
PHELPS DODGE REFINING CORP.
300 PARK AVE. NEW YORK 22, N.Y. • 5310 W. 66th STREET, CHICAGO 38, ILL.

At Shaft and Development Machines, Inc.

We think we have been established and in business long enough to tell you now what we hope to accomplish within the next three or four years.

We are far enough along with our thinking, our experiments and tests and careful analysis of each operation of a complete cycle in shaft sinking and driving drifts that by *radically* different approaches to each and every phase of these jobs, by building equipment specifically for the job and not just fitting the job to standard equipment available, we hope to achieve—

DRIFTING

100-plus feet advance every 24 hours in a 9' x 9' rock heading

SHAFT SINKING

30 feet of completed vertical or incline shaft every 24 hours

and also

Sink exploratory incline winzes on any irregularly undulating and dipping vein (prospect) by full, complete mechanical methods.

Shaft and Development Machines, Inc.

808 Newhouse Building EMpire 3-5373 Salt Lake City, Utah

Home of Whup d'Whup—Cryderman—Safety Sinking Bucket—Betsy — Shaft Jumbos — and others soon to be announced.

In most mining companies, all key officials read E&MJ because it helps them do a better job

If you're not a regular subscriber, Mail this coupon TODAY

ENGINEERING AND MINING JOURNAL,
Subscription Manager,
330 West 42nd St., New York 36, N. Y.

Send me E&MJ for 1 year at applicable rate below.

☐ Check enclosed ☐ Bill Company ☐ Bill me

Name_____ Position_____

Mailing Address: ☐ Home ☐ Business

_____

_____

City_____ Zone_____ State_____

Mining Company_____

Mineral (s) Mined_____

SUBSCRIPTION RATES (1 year): U. S. and possessions, $4; Canada, $5; Latin America and Phillipine Islands, $8; Elsewhere, $15.

To Save Delay, Please Fill Out Completely

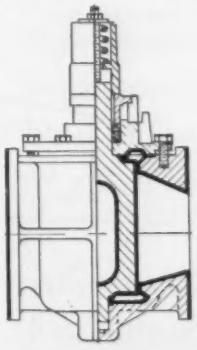
I-10-58

26% Uranium ore in a 1% Sulphuric acid solution

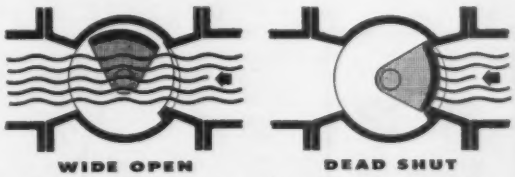
Put that in your pipe and valve it!

And *that's* the process problem that was solved with the installation of iron-bodied, soft rubber-lined DeZurik Valves with an Alloy 20 rubber-covered plug.

It's not surprising to find DeZurik Valves on the roughest services. Whether they're specified first . . . or the last to be tried . . . they stay on and on and on!



All surfaces in the flow pattern can be soft rubber lined in a DeZurik Valve, offering *complete* protection from abrasive or erosive services. There are no internal cavities where slurry material can pack.



WIDE OPEN DEAD SHUT

With DeZurik's *exclusive* Eccentric Action, the plug does not *slide* against the seat. DeZurik Valves *always* close easily—regardless of the pressure inside the valve!

When corrosion, or abrasion — or both — threaten your process lines . . . remember: DeZurik Plug Valves last longer and are usually *less* expensive in the first place.

Representatives in all principal cities, or write for more details

DeZURIK CORPORATION
SARTELL, MINNESOTA

Mexico (*Continued*)

August 1958. All in all, President Cortines' government has paid out around $60-million to Mexican mining companies during the six-year term. The subsidies come in the form of rebates from export taxes and in other lesser aids.

Quickly moving from the gloomy picture of metals, President Cortines proudly announced that sulphur was saving the day for his country's mining and minerals exports industry. In 1955, Cortines noted, sulphur production was only 500,000 tons. This year, 1.2-million tons have been produced.

VENEZUELA

The Venezuelan Development Corp. (CVF), a government agency, has budgeted $1.5-million to be spent in fiscal 1958-59 for studies and initial work on a bauxite reduction plant.

Preliminary proposals are for a plant with capacity of 50,000 tons of aluminum annually, to be built near San Felix on the Orinoco River, in eastern Venezuela. The plant would consume an estimated 60,000 kw of electrical energy supplied by the Caroni Falls hydroelectric plant, scheduled to go into operation late this year.

The CVF budget provides funds for "studies, preparation of the plant project, and initiation of financing and plant construction." Lt. Col. Rafael Alfonzo Ravard, CVF president, says offers of private participation in the project have been received from both Venezuelan and foreign interests.

The plant is expected to use imported bauxite initially. Prospects are believed good for discovery of commerical bauxite deposits in the region south of the Orinoco River delta, but bauxite found to date is not of commercial grade. The Ministry of Mines & Hydrocarbons is carrrying out a bauxite exploratory program.

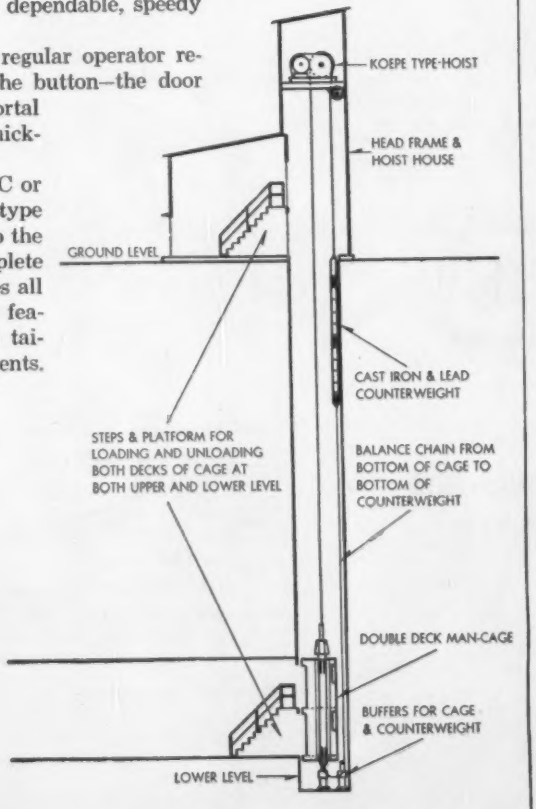
Availability of cheap hydroelectric power from the Caroni River makes the aluminum project feasible. The Caroni Falls plant, also being built by the CVF, will have an initial installed capacity of 200,000 kw, with provision for two additional generators of 50,000 kw each. The plant will supply power for electric furnaces of government steel plants under construction at Puerto Ordaz.

Fully Automatic-Custom Built
CONNELLSVILLE PORTAL CAGE

This is the ultimate in dependable, speedy shaft transportation.

Economical, too—no regular operator required—step in—push the button—the door glides shut and the Portal Cage takes you there quickly—effortlessly.

Powered by either AC or DC friction (Koepe) type hoist which is geared to the speed you desire. Complete installation incorporates all the necessary safety features. Shape and size tailored to your requirements.


KOEPE TYPE HOIST
HEAD FRAME & HOIST HOUSE
GROUND LEVEL
CAST IRON & LEAD COUNTERWEIGHT
STEPS & PLATFORM FOR LOADING AND UNLOADING BOTH DECKS OF CAGE AT BOTH UPPER AND LOWER LEVEL
BALANCE CHAIN FROM BOTTOM OF CAGE TO BOTTOM OF COUNTERWEIGHT
DOUBLE DECK MAN-CAGE
BUFFERS FOR CAGE & COUNTERWEIGHT
LOWER LEVEL

Send for descriptive bulletin

CONNELLSVILLE
MANUFACTURING & MINE SUPPLY CO.
CONNELLSVILLE, PENNSYLVANIA
SERVING THE MINING INDUSTRY SINCE 1901

IN AFRICA

The value of minerals produced in Southern Rhodesia in the first six months of this year has increased by $2,290,400 compared with the first six months of 1957. Total output in the first six months was valued at $26,712,760 and if, as seems likely, production continues at the same rate for the second six months of the year, Southern Rhodesia's 1958 mineral production will exceed last year's record figure of $72,139,200.

In Northern Rhodesia, however, the drop in the world price of copper has resulted in a big decrease in the value of mineral output this year.

Figures for Northern Rhodesia are only available for the first five months of the year and they show that in this period the total value of the Territory's mineral production has decreased by $32,872,000 to $95,349,195.

S. A. Mineral Corp. announced to shareholders that it would suspend manganese mining until further notice. "The heavy curtailment of steel production in the world's principal industrial countries has resulted in a glut of manganese ore and a consequent drop in demand."

Production could re-commence at short notice in view of the existing development of immediately accessible ore and "of steps which will be taken to safeguard the mine property."

Southern Rhodesian Government Department of Mines is trying to encourage the formation of "rockhound" associations of amateur and professional prospectors similar to those in the U.S.

Last year the government ran a series of classes in geology for amateur prospectors and the response to this has been so good that the Mines Department recently published a book on base mineral occurrences in Southern Rhodesia, written in layman's language and designed to help amateur prospectors.

The A.B.C. Symbol . . .

The right to purchase or refrain from purchasing this publication gives you, the reader, and no one else the power to pass judgment on whether it shall continue to survive.

This symbol represents the standards by which your voluntary response is measured.

It testifies to the advertising value of this publication.

It also serves as a constant guide to our readers' opinion.

ENGINEERING AND MINING JOURNAL

SINCE 1866 THE LEADING INFORMATION SOURCE FOR WORLD-WIDE MINING

This symbol represents our membership in the Audit Bureau of Circulations, your assurance that our circulation facts are verified by independent audit, measured by recognized standards, and reported in standardized reports. These audited facts, available without obligation to interested persons, provide a factual basis for advertising rates, evidence of subscriber interest, facts on market coverage, and facts for appraising our circulation quality and editorial vitality.

HALLMARK OF CIRCULATION VALUE

E. A. GODOY & CO., INC.

CUNARD BUILDING, 25 BROADWAY

NEW YORK 4, N. Y.

GENERAL AGENTS

FOR

MINING COMPANIES

UNDERGROUND OR ON THE SURFACE

YOU'LL CUT EXPLORATORY COSTS IN HALF WITH THESE DIAMOND CORE DRILLS

SUPER PIONEER

Here's a rugged compact light-weight drill you can take anywhere. The Super Pioneer eliminates guesswork by giving a true core sample to depths of 100' or more. Designed for one-man operation, drills at any angle in all formations. Gasoline-powered drill and pump weigh just 35 lbs. each.

Basic kit includes drill, pump, and accessories. Rods and bits additional.

$885.00 FOB Spokane

SUPER SCOUT

This all-new air-powered one-man drill sets up and tears down in minutes, eliminating lengthy traffic tie-ups. Hand operated hydraulic feed supplies drilling pressure up to 1500 lbs. Anchor column provides drill support at any angle with or without back wall. Drills in any direction or at any angle to depths up to 100' with exceptionally high core recovery. Weighs just 85 lbs.!

Complete unit includes drill, hydraulic feed, anchor column, hoses, 50' of rods, core barrel, starting barrel, collar pipe, tools, and storage box.

$1175.00 FOB Spokane Diamond bits additional

DIAMOND DRILL CONTRACTING CO.

S. 18 STONE ST. SPOKANE, WASH.

Eastern and Southwestern Distributor, SPRAGUE & HENWOOD, Inc., Scranton, Pa., Grand Junction, Colo. • Export Representative, PHILIPS EXPORT CO., 100 E. 42nd St., New York, N. Y. • Western Canada Distributor, AIR POWER Ltd., Vancouver, B. C.

Africa (*Continued*)

One manganese and two asbestos mines have recently been opened in the Pietersburg district of the Northern Transvaal. The manganese mine is being worked by Pyrolusite Mining Co. (Pty.) Ltd., and the other two properties by W. & B. Asbestos Co. (Pty.) Ltd., and by Consolidated Asbestos.

Several Union mining and finance companies are investing substantial sums in the opening up of the British Protectorate of Swaziland on the eastern border of the Transvaal. Reports say that a leading mining house has already invested $9.8-million in the territory. One of the mining and investment companies, Anglo-Transvaal, has a leg in through Eastern Transvaal Cons. A third group with an interest in the territory is Johannesburg Cons. Investment. The Swaziland Geological Survey reports the presence of extensive deposits of coal and iron ore.

Marlime Chrysotile Asbestos Co., has been granted a 20-year concession from the Bechuanaland Protectorate Government extending over the whole of the Bangwaketse territory (9,000 sq miles) for the exploitation of its manganese resources. Exploratory work is proceeding and mining has been commenced, according to an announcement. It is understood that results so far obtained have been satisfactory.

The final form of the merger betwen two Orange Free State mines, Loraine and Riebeeck, has been submitted to the Supreme Court. An interesting feature of the agreement is the "double-decker" provisions affecting the Riebeeck mine.

Riebeeck has the right to mine the upper reefs in the lease area. If, after 40,000 ft have been developed in this series, it is agreed that a satisfactory mine does not exist, it will have the right to mine the underlying reefs.

If the upper reefs are payable, however, then General Exploration Free State, which has rights over the area, has the right to apply for permission to mine the lower reefs.

The half-yearly report of the Afrikander Lease—a mine in the Western Transvaal area—appears to be very encouraging. Development in the Rietkuil section is very promising and that in the Rhenosterhoek section, while showing a lower uranium value, reflects marked increases in percentage gold payability. Authority to mine uranium in both these areas has been granted. A jarring note is that the company's allocation for uranium output from July 1 has been based on 1957 production. The company is seeking additional quotas.

Eastern Transvaal mining progress on the property at Winkelhaak, a promising venture of Union Corp., has been rapid and the mill is now complete. Owing to faulting and some delays through encountering water-bearing fissures, however, work in the No. 1 Shaft area has not progressed as rapidly as was anticipated.

Africa *(Continued)*

But progress in the No. 3 Shaft area has been encouraging, according to an official report. It is expected that within about 9 months, the mine should have achieved a milling rate of 60,000 tons a month.

Test milling has already started with ore from the surface dump, ore from current development and some ore from stopes in order to bring in some early revenue.

Thanks to record production in the Orange Free State and the Western Transvaal, the Union's gold output reached a new peak in August. These areas produced 14,492 fine ounces more than their record July totals.

And despite substantial decreases elsewhere the grand total exceeded the previous record, set up in July, by 435 oz. August production was 1,499,672 oz.

A modification in shaft pump station layout has been introduced at Riebeeck Gold Mine in the Orange Free State. The new system has reduced the time needed for cutting and the hold-up in sinking operations while this is in progress. Instead of one conventional station to accomodate pumps, switchgear and sump, these are placed in cloverleaf pattern around the shaft. Looking down the shaft the pumps are on the left hand, the sump straight ahead and the switchgear on the right.

IN EUROPE

BULGARIA

The 6-year geological studies of Bulgarian and Soviet specialists operating in southwest Bulgaria were ended successfully when a 3-kilometer gold vein was discovered, Vienna's *Montan Berichte* reports.

The ore vein is about 1.86 miles long and is said to have an average thickness of 11.54-in. According to the Vienna dispatch, Bulgaria will be able to mine about 650,000 metric tons of ore containing an undisclosed percentage of gold.

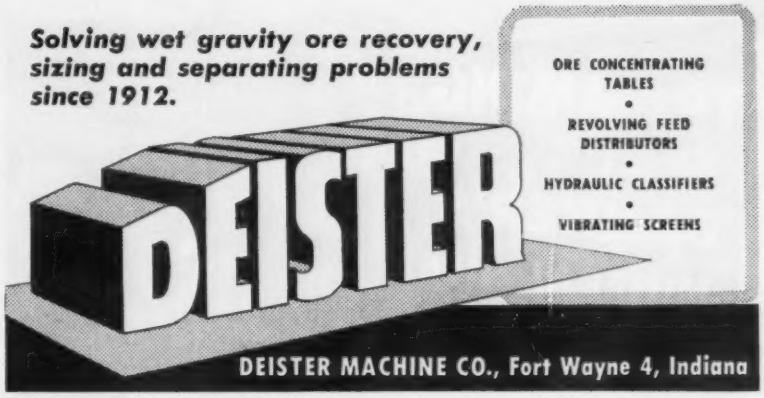
ESTONIA

A phosphate desposit of about 100-million metric tons has been discovered by Soviet geologists near Aseri, Rumania's German-language paper *Neuer Weg* recently reported.

The location of the new deposit is in the general neighborhood of the phosphate mine of Tallinn. In 1957, the phosphorus fertilizer plant of Tallinn produced five-times the all-Russian output of phosphorus before 1918.

The 35-million metric tons Tallinn deposit and the new 100-million metric tons Aseri deposit will push the Estonian SSR to the leadership in the field of mineral fertilizer producers within the USSR.

Solving wet gravity ore recovery, sizing and separating problems since 1912.



T-H YIELDING ARCHES

Cut Costs the Tried and Proven Way

- √ Toussaint-Heintzmann — the original yielding steel arch.
- √ Tested and proven through 30 years of development and research in thousands of installations.
- √ Made of heat-treated steel and available in seven different section weights (8.6 lbs/ft to 29.5 lbs/ft) for maximum economy.
- √ Automatically yielding connections requiring a minimum of attention.
- √ Recoverable and can be repeatedly reconditioned without heat process.
- √ Thorough engineering service is provided.
- √ Maintenance costs cut to a minimum in areas of difficult ground support.

BOCHUMER EISENHUTTE HEINTZMANN & CO.

ROCKIRON

—THE ROCKIRON COMPANY, LIMITED—

Sudbury, Ontario

EASTERN U.S.A. REPRESENTATIVE

The Burridge-Nyland Equipment Company — ISHPEMING, MICHIGAN

TRAMMING
AT
BANNER'S
MINERAL HILL
MINE

ATLAS 1½ TON
TYPE J
STORAGE BATTERY
LOCOMOTIVES

ATLAS CAR & MFG. CO.
1140 Ivanhoe Road
Cleveland 10, Ohio

THERE IS THE RIGHT BIT FOR YOU OUT OF THE MANY POSSIBLE COMBINATIONS OF SIZES AND TYPES

Write today . . . giving all information you can provide. Out of the many combinations possible with four matrices, several stone size ranges, three grades of diamonds, and various face contours we will recommend the bit we believe to be the best suited for your drilling conditions.

Always specify Sprague & Henwood "Oriented" Diamond Bits. They are described and illustrated in Bulletin 320-1.

SPRAGUE & HENWOOD, Inc.
SCRANTON 2, PA.
MEMBER OF: DIAMOND CORE DRILL MANUFACTURERS ASSOC.
New York — Philadelphia — Atlanta — Pittsburgh — Grand Junction, Colo. — Buchans, N.F.
EXPORT REP.: PHILIPS EXPORT CO., 100 EAST 42ND ST., N.Y. 17, N.Y. CABLE ADDRESS: PHILYORK

FINLAND

By the end of next year, nickel ore will be extracted from the Outokumpu Corp.'s Kotalahti mine. The main shaft is already at a depth of 200 meters and will be deepened by an additional 100 meters. The head frame, 77 meters high and equipped with Koepe friction hoists, was ready a year ago. Repair shops and the electrical installations are already standing. The mine will have a transformer substation connected to the national grid.

Preliminary crushing of the ore will be done underground. It will be hoisted in gravel size and passed through the secondary crushing plant, and onto the concentrator and milling plant (not yet built). The nickel concentrate will be taken by rail to the company's central smelter at Harjavalta.

Outokumpu did not give estimates of the size of the deposits or of the future annual production. All that was said was that Finland's domestic needs will be covered several times over and that most of the nickel will be exported (to start in the first quarter of 1960).

GERMANY

A germanium-bearing mineral (Stottit), containing 20% Ge, has been discovered by H. Strunz of the minerology division of the Berlin Institute of Technology. The mineral's tetragonal crystals are several centimeters in length.

Hoesch Werke A.G., Duesseldorf, has begun iron ore mining in French Guinea by acquiring a 5% interest in Cie. Miniere De Conakry. Conakry's deposits are estimated to contain 2.5-million tons.

Among the Cie. Miniere De Conakry owners are: British Iron and Steel Corp. Ltd. (30.5%), Bureau Minier de France (24.7%), Rothschild Group (10%), Caisee Centrale de la France d'Outre Mer (8.7%), Mines de Bor (7.9%), and Hoesch (5%).

A contract has been signed between Fried. Krupp (Essen), and V.S. Dempo and Co., Ltd., (Goa), calling for delivery of an ore crushing plant combined with a grading plant as well as conveying and loading installations.

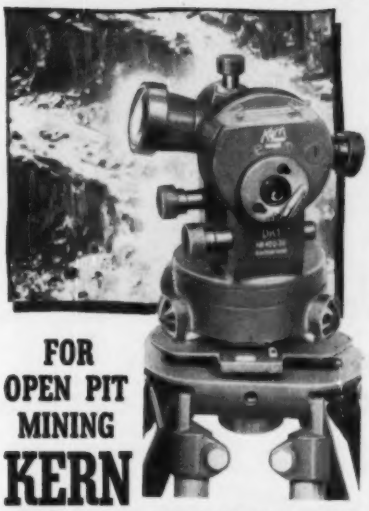
Value of the order is $620,000. Half is due now, and the remaining 50% will be covered by bank guarantees. Delivery will take place in about one year. The electrical equipment will be supplied by Siemens-Schuckert-Werke AG., Berlin/Erlangen.

The new plant will have an ore processing capacity of 220 to 320 cubic meters per hour.

POLAND

The first load of pure sulphur was turned out at the enrichment factory of "Ogorzelec" of Lower Silesia province, Zycie Warzawy, a Warsaw daily reported last week. Full capacity will be reached when filtering melters are installed.

KERN INSTRUMENTS
RIGHT
for the JOB



FOR OPEN PIT MINING
KERN
DKI THEODOLITE

Down-to-fundamentals design ... made for portability, rugged use ... Precision results in simplest, quickest way.

Only 6 lbs. in weight, 7" high, including carrying case.

READINGS at a GLANCE

- Fast, effortless operation.
- Direct to 10', Estimation to 1'.
- Automatically gives arithmetic mean of two readings at opposite circle points

FOR UNDERGROUND OPERATION

- Illuminated Traverse Targets easily interchanged with instrument.
- Water and dust-proof.
- Exceptional clarity of optical system—50% brighter image through Kern AR coating.

★

Write for Brochure DK 518-7

PROMPT, RELIABLE SERVICE
FACTORY TRAINED PERSONNEL
KERN and ONLY KERN
OFFERS YOU
the LATEST DESIGNS of

Dr. Henry Wild

Kern SWISS
The FINEST in SURVEYING EQUIPMENT
KERN INSTRUMENTS INC.
120 Grand St., White Plains, N.Y.

USSR

New diamond and other mineral deposits have been discovered in Yakutia, Eastern Siberia, *Soviet News* reports.

Gold-bearing sands and some deposits of other rare metals have been found in Eastern Siberia and the Far East, according to the newspaper. Other recently reported discoveries in the region include a 300-million ton reserve of iron ore, and deposits of sulphur, fluorite, bauxite and copper-nickel sulphide ores.

About 290,000 persons divided into 5,000 expeditions are prospecting Russia's mineral deposits, newspaper added.

Immense nepheline resources have been discovered in eastern Siberia, according to the Ministry of Geology and Conservation of Mineral Wealth of the USSR. Experts claim that almost the entire area constitutes an accumulation of numerous nepheline deposits, and that the region's reserves are practically inexhaustible.

Large deposits of a peculiar calcite-nepheline ore (Tuvinite) have been discovered at the Balyktya-Khem River. Tuvinite is of a mottled light grey or greenish-grey color and has a fine grain structure. Its nepheline content is 96%. The Russians feel that the proximity of cheap electric power sources (new hydroelectric projects on the Angara and Yenisei Rivers), will transform this area into an important center of aluminum production.

YUGOSLAVIA

The French aluminum producer, Pechiney, will supply technical assistance to two Yugoslav aluminum plants now being expanded and modernized.

The plants are located at Kidricevo and Lozovac. Both have installations for the manufacture of alumina and for electrolytic reduction of aluminum. Production of both items will be expanded as a result of the technical-assistance agreements. At Kidricevo, alumina production will be raised to 90,000, then to 140,000 tpy. The major part of the equipment required for expanding the plants will be manufactured in Yugoslavia.

IN ASIA

INDIA

The French and Italian firms of Pechiney and Montecatini are both bidding for contracts to set up a major aluminum plant in the Salem district of Madras State (south India) where bauxite deposits as well as cheap power are available.

If the French get the contracts, they will most likely collaborate with the National Industrial Development Corp. (NIDC) and the plant, with a slated capacity of 10,000 tons per year, will belong to the state.

The NEW Dings
"CORONATRON"
ELECTROSTATIC SEPARATOR

... proved in use for high efficiency, low cost
DRY SEPARATIONS

It's the *new* electrostatic separator in the mining field . . . and thoroughly job proved for dry separation of a wide variety of minerals ranging from asbestos to vermiculite.

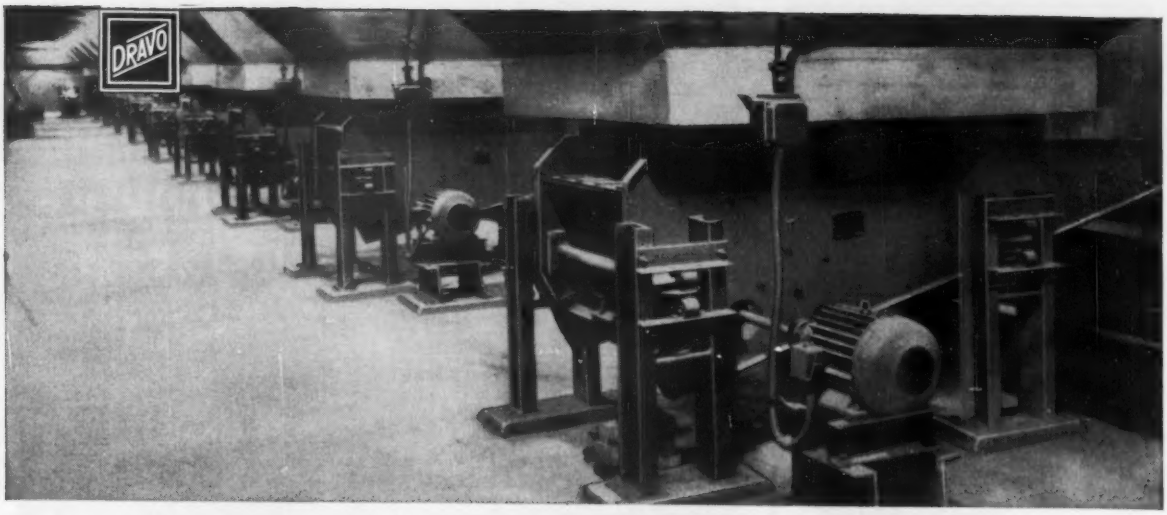
Dings CORONATRON gives you advantages found in no other dry separation unit: The economy of low intensity design; large diameter revolving electrodes for greater dispersion of material; multiple separation zones to obtain concentrate, tailings and recirculated product and to produce extremely high capacities.

If high intensity best solves your separation problems, an exclusive low voltage sparkless electrode is available.

The CORONATRON'S many other profit-making features are well worth your investigation. Write today for literature.

Dings ES-158½

DINGS MAGNETIC SEPARATOR CO.
4716 W. Electric Ave., Milwaukee 46, Wis.



Low maintenance, economical operation with DRAVO-SCHENCK vibrating screens, conveyors, feeders

Low maintenance is the keynote of Dravo-Schenck equipment. In typical installations like the row of feeders shown here, repair and replacement is held to a minimum.

The reason for such economical operation is found in the precision design of the unique "Micro-Thrust" exciter unit which reduces wear by moving material with minimum contact with troughs or screens, and the rugged construction of all wearing parts.

These heavy duty screens, conveyors and feeders are at work in a wide variety of applications—handling ferrous and non-ferrous ores, sinter, chemicals, cement clinker, crushed stone, coal and other abrasive or hard-to-handle materials.

Our engineers will gladly work with you on specific problems or write for Bulletin No. 1475, Dravo Corporation, Pittsburgh 22, Penna.

DRAVO
CORPORATION

CONTRACT CORE DRILLING

EXPLORATION FOR MINERAL DEPOSITS
INCLUDING URANIUM & LIMESTONE — ANYWHERE

FOUNDATION TEST BORING • GROUT HOLE DRILLING

Skilled crews and complete stock of core drills and accessory equipment maintained at all times

Core Drill Contractors for more than 60 years

JOY MANUFACTURING CO.
Contract Core Drill Division
MICHIGAN CITY, INDIANA

WANTED

Rare Earth Properties

CONTAINING Yttrium group or "heavy" rare earth elements: Xenotime, Gadolinite, Euxenite, Samarskite, or similar types of ores.

*Reg. U.S. Pat. Off.

Tell us what you have. Write:
RARE EARTHS AND THORIUM DIVISION
MICHIGAN CHEMICAL CORPORATION
P.O. Box 481, Golden, Colorado • or Saint Louis, Michigan

India (*Continued*)

The Italians are negotiating with private interests in Madras who are in a strong position because, while India wants the plant, it is not anxious to further drain its meager foreign exchange resources.

MALAYA

Malayan tin exports for the first half of this year were the lowest in 10 years due to restrictions imposed by the international tin agreement.

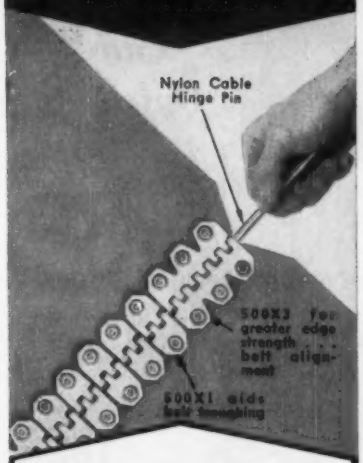
Actual exports during the period totalled 25,960 tons, a drop of 28% from the same period last year.

A ten-man Japanese mission visited Malaya last month to conduct a survey of its iron ore resources.

IN THE PHILIPPINES

Atlas Consolidated milled 272,075 tons in July, averaging 0.70% Cu. Concentrates, estimated to contain 3,402,000 lb copper and 837 oz gold, average 26.4%

WHERE SPEED COUNTS...
use
FLEXCO®
HINGED 500X
BELT FASTENERS



UNDERGROUND COAL MINING

THE IDEAL FASTENER FOR JOINING EXTENSION BELTS. DESIGN PERMITS THE USE OF A SMALLER FLEXIBLE NYLON CABLE HINGE PIN FOR SMOOTHER, TIGHTER JOINTS.

NYLON CABLE HINGE PIN . . .

- Easy to insert or pull out . . . will not migrate.
- Smooth wearing surface—nylon is self-lubricating.
- Will not unravel when cut.

Start now to equip your extension belts with FLEXCO 500X "SEPARABLE" FASTENERS (new FLEXCO HINGED 500X FASTENERS are interchangeable with old HF 500 Fasteners).

HANDY PACKAGE

Carton contains one complete belt joint—fasteners, pin, bolts and nuts.

ORDER FROM YOUR DISTRIBUTOR OR WRITE TO . . .

Flexible
STEEL LACING COMPANY
4635 Lexington St. • Chicago 44, Ill.

Philippines *(Continued)*

Cu. Water shortage at the Toledo mine again cut down milling time to 23 days during the month. The Mati iron mine in Davao shipped 9,800 metric tons.

Barter of 135,000 tons of refractory chrome ore for 30,000 tons of U.S. surplus rice has been arranged. Chrome ore will come from the Masinloc mines in Zambales. Demand from outside buyers has been light.

Palawan Quicksilver Mines, operating on Palawan, is breaking in a third kiln. It now has three Gould rotary type kilns in operation. August production is estimated at 360 flasks, or 27,000 lb of prime virgin mercury.

In spite of low copper prices, Mindanao Mother Lode Mines continues regular production at its Zambales mine. Ore milled averages about 4,600 tpm, averaging 2.3% Cu. Recovery is reported at 88%.

According to an exploration agreement, Benguet Consolidated will conduct extensive work in Palaway on the mineral concessions of Balabac Mining Co. The area is believed to have considerable promise, with two companies now active in mining mercury and chromite.

RIBLET

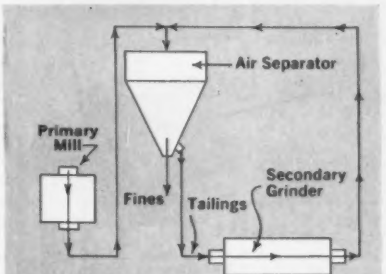
chosen the world over for economical transportation

From Albania to Alaska, mining engineers specify RIBLET aerial transportation systems for their unique capability for overcoming extreme climatic and topographic obstacles. Write for RIBLET'S illustrated brochure of worldwide installations.

RIBLET TRAMWAY COMPANY
Box 7, Station A, Spokane, Washington

STOP OVERWORKING GRINDING MILLS

Boost Production of 40 to 400 Mesh Fines As Much As 300%



STURTEVANT CLOSED CIRCUIT SYSTEM:
Primary Mill runs open, load is circulated through air separator. Desired fines are discharged. Oversize recirculates to secondary grinder and then to air separator for further classification.

Current users of Sturtevant Air Separators include manufacturers of sulfur, soybeans, phosphate, chocolate, feldspar, sand, pigments, limestone fillers, abrasives, plasters, ceramics and cement.

Sturtevant Air Separators Can Lower Power Costs Up To 50%

Production capacity impossible in single-pass grinding results from using Sturtevant Air Separators in closed-circuit grinding systems. They are of proved advantage in all secondary reduction processes.

Fines pass through grinding mills unhindered, are classified, and the oversize returns for further grinding. Grinding mills are free to perform at top efficiency, their output frequently increased as much as 300% and power costs cut up to 50% (documented by 30 years of Sturtevant air separation experience in the cement industry).

Precise Classification; Circulates Loads of 800 tph

Sturtevant Air Separators circulate production loads of up to 800 tph. Simple adjustments make possible counter-action between air currents and centrifugal force to the point where a product of almost any desired fineness may be collected while coarser sizes are rejected.

A 16 FT. STURTEVANT, for example, took a feed rate of 800 tph, containing only a small percentage of desired fines, and delivered 30 tph 90% 200 mesh, recirculating the oversize through the grinding circuit. (In the cement industry, Sturtevant units deliver up to 60 tph raw cement fines, 40 tph finished cement fines.)

Nine models available, diameters from 3 to 18 ft. For more information, request Bulletin No. 087. (Bulletins also available on Micronizers, Blenders, Crushers, Grinders.) Write STURTEVANT MILL CO., 101 Clayton St., Boston, Mass.

LUBRIPLATE
No. 630-2
Multi-Purpose Grease

ALSO PACKED IN

CONVENIENT GREASE GUN CARTRIDGES

Lubriplate No. 630-2 is a high temperature, extreme pressure, water-repellent, grease type lubricant. Ideal for the general lubrication of Industrial, Automotive, Construction, Farm and Marine Equipment. Lubriplate Grease Gun Cartridges provide an easy, quick, economical means of application. Prevent the waste and mess of hand filling. Packed 10 Cartridges in a handy carrying carton.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE

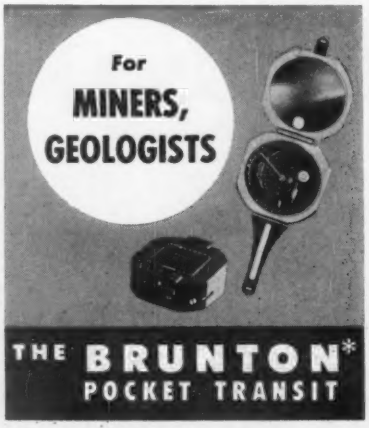
For nearest LUBRIPLATE distributor see Classified Telephone Directory. Write for free "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. LUBRIPLATE DIVISION, Fiske Brothers Refining Company, Newark 5, N. J. or Toledo 5, Ohio.

Philippines *(Continued)*

Lepanto Consolidated milled 38,520 tons in July, producing 4,206 tons of concentrates, estimated to contain 2,372,000 lb of copper and 4,067 oz gold. Concentrates averaged 28.2% Cu. The average copper content of ore milled was 3.23% Cu and 0.135 oz gold per ton.

IN AUSTRALIA

Commonwealth Aluminium Corp. Pty. Ltd. is still investigating the huge project involving the establishment of an aluminum industry on Cape York Peninsula, Australia. One plan envisages a $100-million, 500,000 ton capacity alumina plant and supporting facilities. Other plans, also under examination, will involve a $450-million aluminum smelting plant to produce 250,000 tpy. It is understood that geological testing to date had revealed the existence of more than 200-million tons of economic-grade bauxite in the Weipa area and it is expected that the Cove Peninsula area deposits will considerably increase the total bauxite deposits available. Commonwealth Aluminium Corp. is jointly owned by Consolidated Zinc Corp. and British Aluminium Co.



THE BRUNTON* POCKET TRANSIT

IT'S HANDY...
weighs only 9 oz.; 2¾" x 3" x 1⅛"; easy to carry in pocket, on belt, in car.

IT'S VERSATILE...
ideal for preliminary and supplementary surveying; used as a compass, transit, level, plumb, alidade, clinometer. Shows direction to 1°; level, slope or grade within 1°.

IT'S MADE TO LAST A LIFETIME
"Over 60,000 Brunton Transits since 1896"

See your local engineering supply house or WRITE FOR CATALOG

*Brunton is a registered trademark of

WM. AINSWORTH & SONS, INC.
2151 LAWRENCE ST. • DENVER 5, COLORADO

DO IT THE EASY WAY!

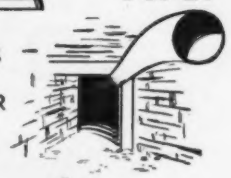
One Man Can Quickly Put Up

NEOLON®

Neoprene Coated Nylon Flexible Ventilation

TUBING!

ONLY 1/24 THE WEIGHT OF METAL PIPE!



plus

- *Neolon Can't Tear*
- *Costs Far Less Than Metal Pipe* (SHIPPED FRT. PREPAID)
- *Can't Dent, Rust or Corrode Like Metal Pipe*
- *Easy To Move and Store*

Send for free sample of Neolon and Catalog 58

AMERICAN BRATTICE CLOTH CORP.
220 S. Buffalo St., Warsaw, Indiana

EVERY MAN AN *Artist*

All kidding aside ...this man is a miner. He's one of the experienced Isbell team with a record for moving over 350 million tons. Selective open pit mining and volume earth moving has long been a specialty with Isbell. Ask us for details —phone Reno FAirview 3-7135.

ISBELL

CONSTRUCTION COMPANY

P. O. Box 2351 • Reno, Nevada
Telephone FAirview 3-7135

Australia *(Continued)*

A second non-Government Australian uranium concentrate export agreement was concluded between the United Kingdom Atomic Energy Authority and United Uranium N.L. & South Alligator Uranium N.L. The two companies operate in the South Alligator River area and the contract is worth $14-million.

Bell Bros., owners of the Horseshoe manganese mine (output 1,400 tons of unusually high-grade manganese ore a week), plan to start production soon on a new manganese field at Nullagine, Western Australia.

Morning Star Mines N.L. report further high gold values on its new reef. Assays for a length of 246 ft over a mining width of 72 in. average 30.4 dwt a ton. Other assays disclosed values up to 36.0 dwt.

Record gold production increased the profit of Central Norseman Gold Corp. N.L. from £A651,757 to £A666,005 in the year ended March 31. During the year the company treated 172,195 (162,715) tons of ore for 95,722 (94,368) oz gold. Ore reserves are estimated at 580,000 (447,000) tons averaging 9.2 (8.5) dwt including 280,000 (66,000) tons on the Crown reef.

Ore reserves of Gold Mines of Kalgoorlie Ltd. have dropped from 1,467,000 tons to 1,338,000 tons averaging 5.8 dwt a ton. The drop is revealed in comparative figures in March 1958 and 1957. In the year to March 31, 1958, the company treated 526,328 (prev. 534,309) tons of ore for 141,044(137,518) oz gold.

Western Titanium N.L. has restricted its production of ilmenite in order not to overflow the market. Quarterly output is now 6,800 tons, but full scale production of other minerals is maintained. Quarterly output of these includes 1285 tons of zircon, 128 tons of monazite, 135 tons of rutile and 65 tons of leucoxene.

Great Western Consol. N.L., Western Australian gold producer, registered another profit drop in year ended March 31. Net earnings were £A51,850 as against £A73,872 in the previous year and £A122,591 two years ago. For the year, the mill treated 535,201(prev.522,291) tons of ore for 78,446 (79,157) oz gold—a recovery grade of 2.93 (3.03 dwt. Ore reserves are estimated at 937,000 tons of quarry and underground ore averaging 3.7 dwt as against last year's 1,190,000 tons averaging 4.0 dwt.

In the Australian fiscal year ended June 30, 1958, mine production of gold was 1,084,628 fine ounces as against last year's 1,062,128 and 1,032,436 in 1955/56. Refinery production of newly-won gold of Australian origin reached 1,106,445 fine ounces as against last year's 1,059,908. Exports of gold in the same period were 405,307 fine ounces as against last year's 908,266 fine oz. In both years, practically all the exports went to Hong Kong.

End

For the successful launching of an industrial project

Your project may not be as pretentious as controlling the flight of a missile but you can chart a successful course of operation for any industrial process, be it a simple routine operation or a highly complexed procedure.

IPEC CONTROL SYSTEMS

... key to successful mechanization

Advances in the instrument and automatic controls industry in the past decade have been truly phenomenal. Instruments and components, with precision and versatility undreamed of a few years ago, are commonplace today. Experienced judgment is essential in their selection and integration into the complete control system. We engineer, design and build control systems for industry ... producing a complete package ... tailored to fit either new or existing facilities. We invite your inquiries on any phase of automation or control work. No obligation.

Industrial Physics & Electronics Company

470 So. 10th East Salt Lake City, Utah
Phone DAvis 8-8678

ASSAYING
CONSULTING
PROSPECTING
ORE TESTING

PROFESSIONAL SERVICES

RESEARCH
METALLURGY
MILL DESIGN
MINE DEPARTMENT

SMITH-EMERY CO.
Assayers and Chemists
SPECTROGRAPHIC ANALYSES
781 E. Washington Blvd.
Los Angeles 21, Calif.

BEHRE DOLBEAR & COMPANY, INC.
Consultants
Mining Geological and Metallurgical
11 Broadway, New York 4, N. Y.
Cable Address—BERDOL

HERON ENGINEERING CO.
Consulting Engineers for all types of Aerial Tramways, Cableways and Suspension Structures.
200 South Acoma St.
Denver 23, Colorado

MERRILL W. MacAFEE
Consulting Engineer
Chemical-Metallurgical-Mining
7668 Santa Fe Ave.
Huntington Park, Calif.
LUdlow 3-1778
FRontier 5-6145

Sprague & Henwood, Inc.
Drilling Service
Foundation Investigation, Test Boring, Group Hole Drilling and Pressure Grouting Diamond Core Drilling
221 W. Olive St., Scranton, Pa., New York, Phila., Pittsburgh, Atlanta, Ga, Grand Junction, Colorado, Buchans, Newfoundland

EDMUND C. BITZER, E. MET.
Mill Design and Operations Consultant
1118 18th Street
Golden, Colorado
Phone CRestview 9-4011

HOPKINS MINING CONSULTANTS LIMITED
Engineers, Geologists, Geophysicists
Maps and Drafting
Room 102, 33 Melinda Street
Toronto 1, Canada
EMpire 4-5642 EMpire 3-7848
HUdson 9-8375

ARNOLD H. MILLER, INC.
Consulting Engineer
General Mine, Mill and Industrial Appraisals
Plant Design, Mechanization and Improvement
Cable: "ALMIL" Tel. Cortland 7-0635
120 Broadway, New York 5

STILL & STILL
Consulting Mining Engineers and Geologists
24 Union Block—Phone 658
P. O. Box 1512
Prescott, Arizona

ALLEN T. COLE AND ASSOCIATES
Consultants—Industrial Minerals
Exploration, Evaluation
Process Development
2815 Cleveland Heights Boulevard
Lakeland, Florida
MUtual 9-9351 MUtual 3-9033

KELLOGG KREBS
Metallurgical Engineer
Mineral Dressing Consultant
564 Market St., San Francisco 4, Calif.
Telephone: SUtter 1-6613

JOHN D. MORGAN, JR. E.M., PH.D.
Consultant
Business and Defense Problems in Metals, Minerals, and Fuels
1001 Connecticut Ave., N.W.
Wash. 6, D.C.
ME 8-1681

JOHN H. STITZER
Specializing in problems of economics, methods and management for open pit and underground mines.
514 N. Plumer Ave.
Tucson, Ariz.
Phone: EAST 5-5221

COWIN & COMPANY, INC.
Mining Engineers & Contractors
Shaft & Slope Sinking
Mine Development
Mine Plant Construction
1—18th Street S. W. Birmingham, Ala.
Phone 56-5566

KIRK & COWIN, INC.
Consulting - Reports - Appraisals
1—18th Street SW
Birmingham, Alabama

ARTHUR NOTMAN
Consulting Mining Engineer
55 Liberty St., 18th Floor
New York 5, N. Y., U.S.A.
Telephone BArclay 7-9484

H. L. TALBOT
Extraction and Refining of Base Metals
Specializing in Cobalt and Copper
Consulting Metallurgical Engineer
Room 911, 209 Washington St.
Boston 8, Mass.

DICKINSON LABORATORIES
Assayers — Chemists
Metallurgists — Umpier Work
Ore Shippers representatives at Local Plants
Sampler-Analysts at Mexican Border Points
1300 West Main St. El Paso, Texas

LAKEFIELD RESEARCH LIMITED
Metallurgical and Chemical Research
Ore Testing
Analysts and Assaying
Box 430 Phone 7
Lakefield, Ontario, Canada

O'DONNELL & SCHMIDT
Mining Consultants
165 Broadway New York 6, N.Y.
BArclay 7-6960
Cables: EXAMINES

CONRAD WARD THOMAS
Mining Consulting—
U. S. and Foreign
EXAMINATION — VALUATION
EXPLORATION
DIVERSIFICATION — FINANCING
Bank of the Southwest Building
Houston, Texas
CApitol 7-5855 Cable "GEOCONS"

FRANCIS H. FREDERICK
Consulting Mining Geologist
690 Market Street
San Francisco 4, California
Telephone: SUtter 1-1562

LEDOUX & COMPANY, Inc.
Metallurgical Chemists — Assayers
Spectroscopists
Representatives of Shippers of Ores and Metals at Buyers Works
Mine Examination Analyses
359 Alfred Ave., Teaneck, N. J.

PENNSYLVANIA DRILLING COMPANY
Subsurface Explorations Grouting
Industrial Water Supply
Mineral Prospecting
Large Diameter Drilled Shafts
Reports
1205 Chartiers Ave. Pittsburgh 20, Pa.

F. C. TORKELSON CO.
Engineers
Industrial Plant Design
Process Development Estimates
Economic Studies Plant Layout
146 South West Temple
Salt Lake City 1, Utah

ABBOT A. HANKS, INC.
Assayers — Chemists
Est. 1866
Spectrographic Analysts
Shippers Representative
624 Sacramento St. San Francisco 11

E. J. LONGYEAR COMPANY
Geological and Mining Consultants
Photogeology
76 So. Eighth St. Minneapolis 2, Minn.
Graybar Bldg.....New York 17, N.Y.
Colorado Bldg.....Denver 2, Colo.
Shoreham Bldg...Washington 5, D.C.
77 York Street.....Toronto, Ontario
129 Ave. De Champs-Elysees Paris, Fr.
Zeekant 35.....The Hague, Holland

AMEDEE A. PEUGNET
Consulting Mining Engineer
Telephone MAin 1-1421
705 Chestnut St., St. Louis 1, Mo.

EARL C. VAN HORN
Consulting Geologist
Mining & Engineering Geology
Box 7, Tel. VE 7-2048, Murphy, N.C.

E. LEE HEIDENREICH, JR.
Consulting Engineers
Crushing Plants Quarries
Milling Plants Plant Design
Plant Layouts Appraisals
75 Second St., Newburgh, N. Y.
9 So. Clinton St., Chicago 6, Ill.

Lottridge-Thomas & Associates
Professional Engineers
705 Judge Building
Salt Lake City 11, Utah

HOWARD G. SCHOENIKE
Consulting Mining Geologist
Examination—Evaluation—Exploration
Metallic and Nonmetallic Minerals
Domestic—Foreign
4039 Turnberry Cir.
Houston, Texas
Tel.: MO 5-7079

HARRY J. WOLF
Mining and Consulting Engineer
Examination—Valuations—Management
One Park Place New York 7, N. Y.
Cable: MINEWOLF
REctor 2-5307

COMPLETE CONSULTING AND MANAGEMENT SERVICES

MINERALS INDUSTRY—WORLD WIDE **SPECIAL SERVICES LATIN AMERICA**

Geological — Mining — Milling — Mechanical — Metallurgical Services — Market Research — Property Appraisals
Diamond Drilling, Mine Development and Production Contracts — Mill and Metallurgical Test Work
Vertical Shaft and Slope Sinking — Newest Equipment — Design and Build Special Mining Equipment — Plants
Process Development — Ventilation Surveys by Expert
Capable Experienced Personnel for all Operations Available

ROGER V. PIERCE AND ASSOCIATES
Registered Engineers
808 Newhouse Building **EMpire 3-5373** **Salt Lake City, Utah**

RESIDENT MANAGER

Immediate opportunity in British Guiana for graduate mining engineer to assume full responsibility for American-owned mining facility. Prefer family man with open pit experience and previous residence overseas. Indicate age, education, and experience in confidential letter.

P-8944 Engineering & Mining Journal
Class. Adv. Div., P. O. Box 12, N. Y. 36, N. Y.

CONSULTANT WANTED

Who understands production of deoxidized copper, tube billets and wire bars for nationally known Refinery in the United States of America. Give qualifications and experience. Write—

HAROLD S. DOWNING,
2212 Oliver Bldg., Pittsburgh 22, Pa.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

Assistant Mill Superintendent—Complex lead-zinc 1500-ton selective flotation mill at 13,000 feet in Latin America needs young, alert assistant mill superintendent with BS degree in metallurgy and five years' milling experience, preferably selective flotation. Knowledge Spanish helpful, but not essential. Three-year agreement, liberal vacation allowance; camp isolated, but confortable, congenial. Schooling provided through eighth grade. Opportunity for establishing connection with major metal producer in stimulating position. If interested, send education and experience resume, photograph, and salary desired to: P-8574, Engineering & Mining Journal.

Experienced Geologist or Metallurgist Account-ant familiar with manganese ore and processing mill needed in New Mexico. Send resume and salary expected to P-9031, Engineering & Mining Journal.

Cone and Jig Operators needed immediately in New Mexico. Send resume of experience to P-9039, Engineering & Mining Journal.

SELLING OPPORTUNITY OFFERED

Sales Engineers—Several openings with major manufacturer of blast hole drilling equipment in domestic field sales. Sales Technical education and previous sales experience in this field are preferred. SW-8852, Engineering & Mining Journal.

POSITIONS WANTED

Mining Engineer 25 years experience mine de-velopment, exploration and operation states and abroad. Supervisory operations or engineering position desired. Employed. PW-8466, Engineering & Mining Journal.

Geologist-Engineer-Economist, 35, married with family, 10 years experience in petroleum and mining geology, minerals economics, process engineering and the purchase of ores and metals; will travel and for work outside U.S.; would appreciate a firm commitment within the next 60 days. PW-8610, Engineering & Mining Journal.

Your Inquiries to Advertisers Will Have Special Value . . .

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publishers to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

MANAGER MACHINERY SALES

Large international corporation has outstanding career opportunity for an engineer with either a mining or mechanical degree. Knowledge export procedures required. Some design and sales experience, preferably in machinery sales department representing various USA manufacturers of heavy machinery in mining, cement and construction fields.

Headquarters—New York City. Some foreign travel. Salary to $9,000.

Send complete resume in confidence to:

P-8843 ENGINEERING & MINING JOURNAL, Class. Adv. Div. P.O. Box 12, New York 36, N.Y.

POSITIONS WANTED

Manager Gen. Supt. 20 years senior positions geology, mining, milling, dredging, construction, transportation administration labor relations. Prefer Latin America position. PW-8762, Engineering & Mining Journal.

Mining Engineer: Experienced as Mine Superin-tendent and second in charge of Property; open pit and underground, safety trained and cost conscious. Desires responsible position in production, Engineering or Administration. Willing to work up in progressive company, will consider any offer where opportunity is available. Reply to PW-8920, Engineering & Mining Journal.

Administrative Geologist, 22 years experience; exploration, resident geology, consulting, and supervisory work. Age 48. Married. PW-8936, Engineering & Mining Journal.

Blasting, 8 years experience drilling, blasting open pit. Like position desired U.S. or Foreign. Married, employed, available on notice. PW-8979, Engineering & Mining Journal.

Mine Superintendent, Married, 39, desires super-visory position preferably in Calif. or southern U.S.A.—experience in Canadian Gold & Base Metal Mines, large & small tonnage, 2 yrs. Mine Supt., 5 yrs. Mine Foreman, 5 yrs. Shift Boss, Employed, require 3 month notice. Apply PW-9002, Engineering & Mining Journal.

Zinc oxide production engineer available for installation of plant, Wetherill or French process, Domestic or Overseas. PW-8989, Engineering & Mining Journal.

BUSINESS OPPORTUNITIES

Mexican Mining Properties have several worth-while properties needing capital to operate. Registered engineer available for mine examination in Mexico. P.O. Box 7006, El Paso, Texas.

Heavy Media Fluorspar Mill, as is, ready for operation—For Rent; Can produce Metallurgical Fluorspar from available ores in area; only experienced Operators should respond. R. A. Browning, Rosiclare, Illinois.

Large Open-Pit Kyanite Deposit in southeast Wyoming for sale or lease. Excellent grade, easily accessible, near railroad. Report available. Write to R. C. Vickers, Consulting Mining Geologist, 1801 Tabor Street, Denver 15, Colorado.

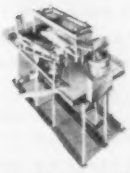
Sixty large tested mines & placers for sale in western states. Assayer Gaskell, 550 Summer, Salem, Oregon.

Investment of $10,000 needed prior stock issu-ance to facilitate working on three mine holdings. Have S.E.C.'s approval for marketing stock. Analysis indicates possibility large profits. Write for interview. Michael Vale, 922 West Academy St., Winston-Salem, N. C.

WANTED

Worn out or discarded
Conveyor Belting
Mines or dealers with accumulation of scrap rubber belting write:
W-8836 Engineering & Mining Journal
520 N. Michigan Ave., Chicago 11, Ill.

FOR SALE
WEMCO MOBIL-MILL NO. 2



7' dia. Wemco Cone Separator
3" Wemco Sand Pump
3' x 16' Allis Chalmers Lowhead Vibrating Screen
25' Bucket Elevator for Media Return
24" x 17' Wemco Densifier
De-Magnetizing Coil
Rectifier, 115 Volt DC
30" x 7' Dings Magnetic Separator
Power Center, complete with controls

EXCELLENT CONDITION

MACHINERY CENTER, INC.

P. O. Box 964 - Salt Lake City - 1201 S. 6th West
HU 4-7601

STRACHAN—Equipment Bargains for Open Pit and Underground Mining

12-EUCLID Model 36-TD, Rear Dump, Capacity 22 Tons, 15 Yd. 20 Yd. 1 to 1 Cummins Diesel Powered, Allison Torque Converter. Full Recapped Tires.

2-BUCYRUS-ERIE SHOVELS, Electric, 4 Yd. Model 120-B, 34' boom, 26' stick, Reconditioned Motors, gearing good.

2-BUCYRUS-ERIE SHOVELS, Model 54-B Caterpillar D-17000 powered, torque converter 2½ yd. dipper 26' boom 18' stick

BLAST HOLE and ROTARY DRILLING Equipment and Tools Available.

2-EIMCO 12-B Mucking Machines, Rebuilt.

5-INGERSOLL-RAND Air Slusher Hoists, Model ASNMOH, Rebuilt.

PARTIAL LISTING ONLY
YOUR INQUIRIES INVITED

STRACHAN MACHINERY COMPANY

610-16th Street, Oakland, California
Cable: "Stramach San Francisco"
International Export Sales

NEED A PIPELINE?

Three inch and larger diameter line pipe available for rent, sale, or lease-purchase. Pipe can be furnished coated and wrapped if desired. Immediate delivery anywhere.

Pipe Rental & Supply Company
P. O. Box 1671
Phoenix, Arizona

ALASKA JUNEAU SPECIALS

Why? Extra Low Cost, Low Ocean Freight

BALANCES
2—Keller Gold Balances, 1/300 M.G.
2—Ainsworth Analytical, 1/250 M.G.
BAGS
75—Bales—17" x 28" Jute Ore Bags, 20 oz. NEW
100—Bales—17" x 29" Elastic Linings, NEW
BALLS
400 Ton—6" Forged Steel Grinding Balls
BLOWERS
4—Buffalo, Size 27, 10 HP, 7½ and 5 HP Motor
1—Roots, Size 710, Type AFS, NEW
1—Roots, Size 3½, Excellent
CRUSHERS, JAW & GYRATORY
2—36" x 48" Birdsboro Buchanan Jaw, complete with 2—150 HP Motors, 2200 volt.
3—#8K Allis Chalmers Gyratory, complete with 100 HP G.E. Motor, 2200 volt.
CRUSHING ROLLS
1—6" x 10" McFarland-Eggers-Denver, less motor
2—60" x 24" Traylor Type AJO, complete with motors, 2200 volt.
DUST COLLECTOR
1—10' Cyclone Type, W/Buffalo Blower & Duets
FANS
1—#27 Buffalo, 7½ HP TEFC 220 V
1—#5½ Buffalo Conoidal, Type CLD, less motor, Brand New
1—3½" Buffalo Baby Conoidal, Type ICN
FEEDERS
6—60" x 6'6" Apron Ore Type, Mang. steel liners, Rebuilt
24—30" x 5' Apron Ore Type, less motor
FILTER
1—3' x 4' Oliver Drum, complete w/Vacuum pump
FLOTATION MACHINES
2—6 Cell No. 18 (28 x 28) Denver Sub A, Reconditioned
3—5 Cell 66" x 66" Fagregren, 15 HP Motors
FURNACE
1—DFC Assay Furnace, elec. operated, Brown Pyrometer, 220 volt, modern
1—DFC Single Muffle, oil fired, w/blower
JIGS
1—18" x 18" Simplex Pan American Pulsator Type "A"
1—12" x 12" Simplex Pan American Pulsator Type "A", Brand New

MAGNETIC PULLEY
1—26" Face x 24" dia. Dings, non-permanent type, with or without M-G set
MILLS, BALL-TUBE
2—8 x 6 Marcy Type Ball Mills, Wave Type Liners 225 HP Westinghouse Syn. Motor, 2200 volt. Excellent
12—6 x 6 Marcy Type, Manganese grates, 225 HP, Westinghouse Motor, 2200 V.
6—6' x 12' Allis Chalmers Type Ball-Tube grate discharge, 150 HP motor, 2200 V.
2—6' x 9' Allis Chalmers Ball Mills, 150 HP motor, 2200 V.
PUMPS
6—5" Wilfley Model C, 75 HP Motors, 2200 V.
16—4" Wemco, Model C, iron lined, rebuilt
2—3" Wilfley, Model C, iron lined, reconditioned.
1—3" Wemco, New, less motor
1—2" Wilfley, New, less motor
2—1" Wilfley, less motor, Reconditioned
1—3RV-15 IR—15 HP, 220/440 V, Rebuilt
1—12" x 10", Fire Pump, 1200 gpm @ 300'
1—Size 3½ x 8" Platt Triplex Pump, less motor
1—1R Model 25, Sump Pump
SAMPLE CUTTER
1—Geary Jennings Sample Cutter, Wet Type, 115V.
SCREENS
14—4' x 5' Tyler, Single Deck, Type 38 Vib.
2—2' x 4½' Niagara, Single Deck
4—4' x 8' Niagara, Single Deck, 5 HP Motor
6—3' x 6' Tyler, Single Deck, less motor
CYLINDERS, AIR
12—18" x 30"—Air Cylinders, 2 way valve
5—8" dia. x 49"—Cylinders, 2 way valve

CARS, MINE
140—10 Ton Rotary Dump, 30" gauge
2—Rotary Dump, for 10 ton Cars. Cap. 4 cars, 75 HP Motor
CRANES, BRIDGE
1—25 Ton Shaw, 20'9" Span
1—15 Ton Cyclops, 30' Span
COMPRESSORS
1—1500 cfm Worthington, Size 23 and 14 x 16, 300 HP Westinghouse Syn. Meter, 2200 volt
2—750 cfm Ingersoll Rand, Size 18 x 11 x 16, 150 HP West. Motor, 2200 volt
CONVERTER
1—300 KW Westinghouse Synch. Converter, 600 V. DC, W/controls
DRIFTERS
5—Model D89 Gardner Denver, 1⅛" hex.
4—Model 17-L G.D. 1¼" round
DRILL, DIAMOND
1—Mitchell, W/air motor, EX Rod
GENERATORS, M-G
1—6KW G.E., 109 Amps, 110 V. Meter 220 V.
1—1½ KW G.E., 250 V DC, 3 HP Motor, 220/440 V
1—18 KW, Westinghouse, 125 V, DC, complete W/Panelboard
1—75 KW G.E., 500 V DC, 115 HP Motor, 2200 V. W/Controls
1—100 KW Western Electric, 125 V DC, 150 HP Motor, 220 V, W/Controls
HOISTS, MINE SHAFT
1—800 HP Nordberg Double Drum, 43,700# @ 1000 fpm. 10' dia. x 63" face, Lilly controls, complete W/motor and controls, EXCELLENT
1—300 HP Wellman-Seaver-Morgan Single Drum, 16,500 # Pull @ 825 rpm, 72" dia. x 60" face, dynamic braking, 300 HP motor, 2200 volt
1—150 HP Wellman-Seaver-Morgan Double Drum, 8400 lbs. @ 500 fpm, 60" dia. x 42" face, Post type brake, complete with motor and controls
1—100 HP Coeur d'Alene, single drum, 36" dia. 36" face, band type braked, Herringbone gears, complete with motor and controls
1—50 HP Ottumwa, single drum, 46" face x 42" dia. post brakes, Herringbone gears, 50 HP DC or AC Motor W/controls

ALL LOCATED JUNEAU, ALASKA—TREMENDOUS AMOUNTS OF WAREHOUSE STOCK & PARTS STILL AVAILABLE
WRITE FOR LISTING—WRITE, PHONE, WIRE

MACHINERY CENTER, INC.

SALT LAKE CITY, UTAH, TEL HUnter 4-7601 1201 SOUTH 6TH WEST, P. O. BOX 964

NEW RAIL
20# — 30# — 40#
IN STOCK
LEFTON INDUSTRIAL CORP.
GENERAL OFFICE: 212 Victor St.
St. Louis 4, Mo.

7—25-ton, 45-ton, 65-ton & 80 GE diesel electric locomotives
3 Jaw Crushers—Traylor 48x60 & 36x42
6—720' Joy WN 102—13x8x7, 150 HP
440 v air cooled air compressors
Hardinge mills 4'6"x16, 6'x48", 10'x48"
Rod mills 4'x8', 5'x12' & 8'6"x12"
Ball mills 6'7"x6', 7'x6' & No. 96
STANHOPE, 60 E. 42d St., N. Y., N.Y.

FOR SALE
1—4' x 30' x 15' Dorr Bowl Classifier
2—24' x 14' Steel tanks with agitators
3—60' x 12' steel sand tanks
2—14' x 18' Oliver filters
1—21' x 10' C P vacuum pump
Located in Nevada.
Reply: F5-8906 Engineering & Mining Journal
68 Post St., San Francisco 4, Calif.

When you need...
LOW COST—DEPENDABLE
INDUSTRIAL RUBBER PRODUCTS
call **CARLYLE**
FOR ALL YOUR REQUIREMENTS OF
RUBBER HOSE

Air	Discharge	Suction
Acid	Fire	Water
Paint Spray	Fuel Oil	Steam
Solvent	Oil Suction	Vacuum
Welding	& Discharge	Pneumatic
Pile Driver	Gasoline	Road Builders

BELTING

Conveyor	Grader	Hot Material	V-Belts
Elevator	Chute Lining	Mucker	Transmission

PROMPT SHIPMENTS LOW COST QUALITY PRODUCTS

CARLYLE RUBBER CO., INC.
103-107 Warren St., New York 7, N. Y. Digby9-3810

OVERHEAD ELECTRIC TRAVELING CRANES: One 80 ft. span, 25 ton, 4 motor, 220/440 volt A.C., Trolley New 1955. One 56 ft. span, 3 motor, 110 volt, direct current. The above with or without runways and DC Generator.
LOCOMOTIVES, DIESEL ELECTRIC: 4—General Electric and General Motors, 80 ton, standard gauge, New 1956. 4—Porter and 1—General Electric, 35 and 45 ton, 36" gauge.
CLASSIFIERS: 2—Akins and two Wemco 78" double pitch, duplex, 36 ft. steel tanks, complete with motor, drive, etc., New 1956, condition guaranteed. One Dorr 19' x 8' x 37'6" Bowl & Rake Classifiers, complete with motor and controls, New 1956, condition guaranteed.
HEAVY MEDIA PACKAGE UNIT: Semi-portable, bolted construction, capacity 30 TPH, complete with 7 ft. Cone, Densifier, Pumps, Magnetic Separators, Rectifier, Controls, etc. Condition guaranteed. Also one 130 TPH capacity.
PULVERIZER: Marcy 8' x 12' Rod Mill, center peripheral discharge, complete with 350 H.P. motor, speed reducer, etc. New 1955. Condition guaranteed.
DRYERS, KILNS, COOLERS: Two 8' x 124' Kilns. One 9' x 130' Kiln. One 10' x 200' Kiln. One 6' x 50' Kiln. One 6' x 50' Dryer. One 104" x 65' Dryer, double shell, with all auxiliary equipment. One 6' x 50' Cooler.
JAW CRUSHERS: 4" x 8" to 48" x 60".
REDUCTION CRUSHERS: Nordberg 4¼ ft. Cone. Also one 54" Gyradisc. Both with 200 H.P. motors and drives. New 1955.

WE BUY AND SELL EQUIPMENT THROUGHOUT NORTH AND CENTRAL AMERICA
A. J. O'NEILL
Lansdowne Theatre Building
Lansdowne, Pa.
Phila. Phones: MAdison 3-8300—3-8301

MORSE—FOR ALL YOUR EQUIPMENT NEEDS

JAW CRUSHERS
6—2¼" x 3½" New Morse Lab Crushers
6—4" x 6" New Morse Lab Crushers
1—6½" x 7" Hendy Jaw Crusher
1—9" x 16" Day Jaw Crusher
1—8" x 15" Wheeling Jaw Crusher
1—10" x 20" Pacific Jaw Crusher
1—15" x 24" Universal Jaw Crusher
1—9" x 36" Cedar Rapids Jaw Crusher
1—42" x 48" Traylor Jaw Crusher
2—5" x 6" New Morse Jaw Crushers

BALL AND ROD MILLS
1—4' x 4' Marcy Ball Mill
1—6' x 4' Hardinge Conical Ball Mill
1—6' x 6' Allis-Chalmers Ball Mill
1—7' x 5' Allis-Chalmers Ball Mill
1—8' x 22' Hardinge Conical Ball Mill
1—3' x 7' Morse New Rod Mill
1—4' x 10' Hardinge Rod Mill
2—5' x 10' Traylor Rod Mills
1—5' x 10' Hendy Rod Mill
1—4' x 4' Hersch Ball Mill

FLOTATION MACHINES
1—#7 Morse "Jetair" Hydra-cell, 22" x 22"
1—4-cell Morse-Weinig, 24" x 24"
1—2-cell Fagergren, 66"
1—4-cell Fagergren, 66"
1—8-cell Fagergren, 56"
1—2-cell Agitair #24
1—Denver unit cell #250
7—2-cell Fagergren, 62"
1—6-cell Denver #21, 38" x 44"
1—4-cell Denver #21, 38" x 44"
1—6-cell Denver #18, 28" x 33"

LOCOMOTIVES—DIESEL
1—4-ton Goodman Diesel, 18" ga.

LOCOMOTIVES—BATTERY
4—1½-ton Mancha "Little Trammers," 18" ga.
1—1½-ton General Electric Trammer
3—3½-4 ton Mancha Locomotives, Titan "A"
1—4 ton Westinghouse-Baldwin Locomotive
2—6 ton General Electric Locomotives
2—7 ton General Electric Locomotives
1—7 ton Atlas Locomotive
3—8 ton Ironton Locomotives
2—8 ton Goodman Locomotives
2—8 ton General Electric Locomotives
1—9 ton Whitcomb Locomotive
4—10 ton Atlas Locomotives

LOADERS
17—Eimco 12B, 18" ga.
8—Eimco 21, 18" & 24" ga.
3—Gardner-Denver Model 9, 18" ga.
1—Joy HL3, 18" ga.
1—Joy HL20, 24" ga.
1—Hough Payloader, Rubber Tired, Model HL

AIR SLUSHER HOISTS
1—Ingersoll-Rand Model A5NNOH
1—Joy Model FF211
1—Joy Model S-211

AIR TUGGER HOISTS
2—Ingersoll-Rand Model D6U
9—Ingersoll-Rand Model EUA
2—Ingersoll-Rand Model 10HR
5—Gardner-Denver Model HK
2—Joy Model F113
3—Ingersoll-Rand Model HU

ELECTRIC TUGGER HOISTS
1—5-HP Sullivan, Single Drum, Model DE
2—7½-HP Sullivan, Single Drum, Model HE
4—5-HP Sullivan, Double Drum, Model HDE
2—15-HP Ingersoll-Rand Model 15NN-1G
2—20-HP Ingersoll-Rand Model 20NM2C

MINE HOISTS—SINGLE DRUM, ELECTRIC
1—10-HP Vulcan #0
1—15-HP Vulcan
1—20-HP H&B
1—25-HP Vulcan #1½
1—30-HP Vulcan #22C
2—40-HP Vulcan
1—50-HP H&B
1—50-HP W. A. Box
1—75-HP Vulcan
2—100-HP W. A. Box
1—112-HP Vulcan
1—150-HP Vulcan
2—150-HP Ottumwa
1—250-HP Ottumwa

MINE HOISTS—DOUBLE DRUM, ELECTRIC
1—75-HP H&B Complete with Steel Headframe
1—75-100-HP, Clutched Drums, Post Brakes
1—82-HP Vulcan #5½
1—100-HP Webster, Clamp & Lane
1—150-HP Jackson

SAND PUMPS
3—1" Deco
1—1½" Kimball-Krogh
5—2" Wilfley
1—2" Denver
2—2" A.S.H. Hydroseal
3—2" Galigher, Vac-Seal
4—3" Wilfley
1—3" A.S.H. Hydroseal
2—4" Wilfley
2—4" A.S.H. Hydroseal
1—6" Amsco Dredge Pump

GYRATORY CRUSHERS
1—2' Symons Standard Cone Crusher
1—2'4" Traylor Type TY Gyratory
1—3' Traylor Type TY Gyratory
1—3' Traylor Type T Gyratory
1—2' Traylor gyratory

ROLL CRUSHERS
2—16" x 10" McFarlane Crushing Rolls
1—40" x 20" Cedar Rapids Crushing Rolls

PORTABLE COMPRESSORS
1—210 CFM LeRoi Portable Compressor. Gas Engine Driven
1—600 CFM Ingersoll-Rand "Gyroflo" Portable Compressor, Diesel Driven

CONCENTRATING TABLES
10—Deister No. 6 Concentrating Tables

VIBRATING SCREENS:
1—4' x 10' Allis Chalmers Double Deck Screen
1—3' x 7' Robins Gyrex S.D. Screen

NOW LIQUIDATING TWO COMPLETE MINING AND MILLING PLANTS OF WAH CHANG MINING CORP. AT BISHOP, CALIF., AND TEMPIUTE, NEVADA. SEND FOR INVENTORY.

MORSE BROS. MACHINERY CO.

EST. 1898

2900 Brighton Blvd. P. O. Box 1708 Keystone 4-5261 DENVER, COLORADO

LOCOMOTIVES

BLOWER — DRILLS

Three 80 ton G.E. Diesel-Electric Locomotives. Like new—built 1955. 42" track gauge, will alter to suit.

One Ingersoll-Rand Motor Blower, Type FS—never used.

Four Blast Hole Drills, Bucyrus Erie 42 T Electric, with accessories. In good operating condition.—Bargain price.

1—Joy Axivane Series 1000 Fan, Model 42½-26½ 1150 B.D., 30,000 C. F. M. at 3" W. G. Complete with drive and 25 H.P. Motor, 250 volt, D.C.—Excellent condition.

COALDALE MINING COMPANY, INC.
Lansford, Pennsylvania
Lansford 1619

Several hundred feet AW and NX drill rods NX flush joint casing, some never used at two thirds original cost.

Herbert M. Stanley
4221 Arcady, Dallas, Texas

6' x 60'—7½' x 50' & 8' x 60' dryers.

CRUSHERS:
1—24" x 36", 18" x 36", 12" x 24" Jaw Crusher #332 A-C Hydro-Cone.
2—42" x 16" Allis-Chalmers Crushing Rolls 36" x 16" rebuilt Sturtevant rolls
1—24" x 12" Farrell Bacon Crushing Rolls 28" Telesmith Intercom Crusher 6", 10", 20" McCully Super Gyratory Crushers No. 3 up to No. 12 Gyratory Crushers
1—15 Ton Lime hydrating plant

BALL & TUBE MILLS:
5½' x 20' & 6' x 22' & 7' x 24' & 7' x 35' Tube Mills
6' x 120' & 9' x 160' kilns.

W. P. HEINEKEN, INC.
50 Broad St., WH 4-4236 NEW YORK 4, N. Y.

Four—Mine Locomotives
Approximately 4 years old—complete with batteries. Priced to move.

6000' 60# relaying rails
15' lengths. Excellent condition, with angle bars, switchpoint and frogs.

WEISSBUCH STEEL SUPPLY CO., INC.
Tenth & Virginia, M.C.R.R., Gary, Indiana,
P. O. Box 629

FOR SALE

CRUSHERS—MILLS
1—Conical ball mill—Hardinge 4'6"x16", 25 HP, w/feeders, elevators, screens, etc.
1—Rod Mill—Marcy 7'x15', 300 HP
4—Gyratory—K-V-S #49, 38½, 19
1—Cone—Symons 3' Standard
1—Hammermill—Penna. #5060, 400 HP, 1952, Unused
4—Ball Tube Mills—Al. Ch. 5'6"x22'
2—Ball Mills—Marcy #64½, #66
3—Ball Mills—Hardinge 8x36, 8x48, 10x48

DRYER & KILNS
2—8'x170'—¾" shell, (3) tires
4—7'x120'—9/16" shell, brick lined
1—8'x115'—⅞" shell, 2 tires
2—8'x70'—Double shell, indirect heat
15—Vetory dryers: 6'x50'; 5'6"x50'; 4'8"x33'; 4'6x40"; 4'6"x3½'; 4'x12'; 3'x15'
1—4'x24'—Brick lined kiln

CONVEYOR
2700'—16" & 24" all-steel trough-belt conveyor

PERRY EQUIPMENT CORP.
1419 N. 6th St. Phila. 22, Pa.
POplar 3-3505

ADVERTISERS IN THIS ISSUE

***Indicates more product information may be found in company advertising appearing in E&MJ 1958 Mid-June Mining Guidebook and Buying Directory Issue. Check your Guidebook Index.**

*Aero Service Corp. 30
*Ainsworth & Sons, Inc., Wm. 204
*Allen-Sherman-Hoff Pump Co. .. Second Cover
Allis-Chalmers Mfg. Co.
(General Products Div.) 144
Allis-Chalmers Mfg. Co.
(Industrial Equipment Div.) A..... 175
Allis-Chalmers Construction Machinery
Div. 78-79
*American Brass Co.,
American Metal Hose Div. 179
*American Brattice Cloth Corp. 204
*American Cyanamid Co.
Insert between pp. 64-69
American Manganese Steel Div.,
American Brake Shoe Co. 155, 191
Atlas Car & Mfg. Co. 200
Atlas Copco 154
Atlas Powder Co. 56

Bechtel Corp. 63
Bemis Bro. Bag Co. 182
Bethlehem Steel Co. 72, 129, 173
Birdsboro Steel Foundry & Machine Co. . 60
Blaw-Knox Co. 177
Boston Woven Hose & Rubber Co. 189
Bucyrus-Erie Co. 69
*Buell Engineering Co., Inc. 170

Calvert School 187
*Card Iron Works, C. S. 185
Caterpillar Tractor Co. 5, 212
Chevrolet Div. of General Motors 26
Chicago Pneumatic Tool Co. 70-71
*Christensen Diamond Products 159
*Colorado Fuel & Iron Co. 138
*Connellsville Mfg. & Mine Supply Co. 196
Crane Co. 166
Cummins Engine Co. Insert between pp. 124-129

DeZurik Corp. 195
Deister Concentrator Co. 168
Deister Machine Co. 199
*Denver Equipment Co. 121
Detroit Diesel Engine Div., General Motors 8-9
*Diamond Drill Contracting Co. 198
Differential Steel Car Co. 190
Dings Magnetic Separator Co. 201
Dodge Mfg. Co. 68
Dow Chemical Co. 82-83
Dravo Corp. 202
duPont de Nemours & Co., E. I.,
Expl. Dept. 146

*Eimco Corp. 39
Electric Steel Foundry Co. 54
Ellicott Machine Corp. 186
*Ensign-Bickford Co. 49
Euclid Div., General Motors 171

*Falk Corp. 61
*Fate-Root-Heath Co.,
Plymouth Locomotive Works Div. 36
Flexible Steel Lacing Co. 203
Firestone Tire & Rubber Co. 62
Foote Bros. Gear & Machine Corp. 180
Ford Motor Co., Truck Div. 137, 139, 141, 143, 145, 147, 148-149

*Galigher Co. 188
General American Transportation Corp. .. 193
Georgia Iron Works Co. 52
*Godoy & Co., E. A. 198
*Goodrich Aviation Products, B. F.,
A Div. of B. F. Goodrich Co. 65
Goodrich Industrial Products Co., B. F. .. 3
Goodrich Tire Co., B. F.,
A Div. of B. F. Goodrich Co. 123

*Harbison-Walker Refractories Co. 33
*Hardinge Co. 172
*Harnischfeger Corp. 28-29
*Hewitt-Robins 181
Huber-Warco Co. 165

*Industrial Physics & Electronics Co. 205
Infilco, Inc. 192
*Ingersoll-Rand 1
International Harvester Co.
(Drott Mfg. Corp.) 73
International Nickel Co. 64
*Isbell Construction Co. 205

Jenkins Bros. 119
Joy Mfg. Co. 31, 202

Kaiser Engineers Div., Henry J. Kaiser Co. 16
Kennedy-VanSaun Mfg. & Engrg. Corp. .. 169
*Kern Instruments, Inc. 201
Koehring Div. of Koehring Co. 10-11

Lawrence Pumps, Inc. 176
LeRoi Div., Westinghouse Air Brake Co. 74-75
*LeTourneau-Westinghouse Co. 51, 53, 55, 57
Lectromelt Furnace Div.,
McGraw-Edison Co. 34
Lima Works, Construction Equipment Div.,
Baldwin-Lima-Hamilton Corp. 38
Lubriplate Div., Fiske Bros. Refining Co. . 204

*Mack Trucks, Inc. 80-81
Marion Power Shovel Co.,
A Div. of Universal Marion Corp. 14
Michigan Chemical Corp. 202
*Mine & Smelter Supply Co. 76-77
Minneapolis-Honeywell 152
Mixing Equipment Co., Inc. 178

*National Malleable & Steel Castings Co. .. 27
*Naylor Pipe Co. 136
New York Engineering Co. 192
*Nordberg Mfg. Co. 12-13

Ohio Brass Co. 25

Permutit Co. 160
Phelps Dodge Refining Corp. 194
Porter Co., Inc., H. K.,
Leschen Wire Rope Div. 187

Republic Steel Corp. 58-59
*Riblet Tramway Co. 203
Ridge Tool Co. 158
Rockiron Co. 199
Roebling's Sons Corp., John A. 140

Searchlight Section 206-210
Shaft & Development Machines, Inc. 195
*Simplex Wire & Cable Co. 15
Smit & Sons, Inc., J. K. 184
*Sprague & Henwood, Inc. 200
*Standard Oil Co. of California 42
*Stearns-Roger Mfg. Co. 174
Stoody Co. 183
Straub Mfg. Co. 157
Sturtevant Mill Co. 203

*Texas Co. 6-7
Thermoid Co. 167
Thompson Products, Inc., Valve Div. 35
Timken Roller Bearing Co. .. 41, Fourth Cover
*Traylor Engrg. & Mfg. Co. 142
Turbo-Mixer Div. of General American
Transportation Corp. 193

United States Rubber Co.
(Mech. Goods Div.) 117
*United States Steel Corp. 32, 135

*Vulcan Iron Works Co. 151

Walworth Co. 40
Wedge-Wire Corp. 156
West End Chemical Co. 133
*Western Machinery Co. 131
*Western Rock Bit Co. 150
Wheel Trueing Tool Co. ..... Third Cover
Wheelabrator Corp. 186
Wickwire Spencer Steel Div.,
Colorado Fuel & Iron Corp. 50
Wild Heerbrugg Instruments, Inc. 153
*Wilfley & Sons Co., A. R. 84

Yuba Mfg. Div.,
Yuba Consolidated Industries, Inc. 37

PROFESSIONAL SERVICES 206

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 207
EQUIPMENT
Used or Surplus New)
For Sale 207-209

ADVERTISING SALES STAFF

Atlanta 3 ..... M. H. Miller, 1301 Rhodes-Haverty Bldg., Jackson 3-6951
Chicago 11 .. G. A. Mack, F. W. Roets, 520 N. Michigan Ave., Mohawk 4-5800
Cleveland 13 ..... J. E. Lange, Illuminating Bldg., 55 Public Square, Superior 1-7000
Dallas 1 .... F. E. Holland, 1712 Commerce St., Riverside 7-5117
Denver 2 ..... J. W. Patten, Mile High Center, 1740 Broadway, ALpine 5-2981
Los Angeles 17 .. J. B. Uphoff, 1125 W. 6th St., Huntley 2-5450
New York 36 .. H. C. Chellson, R. W. Peckham, 500 5th Ave., Oxford 5-5959
Pittsburgh 22 ..... Wm. H. H. Ginder, 1111 Oliver Bldg., Atlantic 1-4705
Philadelphia 3 ..... J. B. Lewis, 6 Penn Center Plaza, Locust 8-4330
St. Louis 8 ..... F. W. Roets, Continental Bldg., 3615 Olive St., Jefferson 5-4867
San Francisco 4 ..... J. W. Otterson, 68 Post St., Douglas 2-4600
EUROPE ..... Michael R. Zeynel, 15, Landgraf - Wilhelm Frankfurt/Main, Germany
McGraw-Hill House, E. E. Schirmer, 95 Farrington St., London, E.C. 4

WHERE THERE'S BUSINESS ACTION THERE'S A BUSINESSPAPER

Used to be a song, back in the Thirties, titled, *Little Man, You've Had a Busy Day.* Didn't mention the Big Man. But his days are busy, too. He's the man who must make top-level decisions in business. And to make those decisions, he must have facts. All the facts. All the pertinent information he can get.

He finds time, in his busy days, to get that information. How? By getting a major portion of it from one unique source: the business publications serving his particular field.

No businessman, Little or Big, is fully informed until he reads his businesspaper. He reads it for profit, not for pleasure. He searches it through for news of the trade or industry. For facts. For fresh ideas. For new products he can put to work. And he reads the advertising with the same intense concentration he devotes to the editorial pages.

For the man on his way toward becoming a Big Man, his businesspaper is especially important. Take a tip from the reading habits of key men at every level. Take out a subscription of your own. Then, make the time to read every issue—and read it thoroughly.

WHERE THERE'S MINING BUSINESS THERE'S . . .

ENGINEERING AND MINING JOURNAL

One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

CAT FUEL INJECTION EQUIPMENT CUTS COSTS BY PROVIDING MAXIMUM ENGINE PERFORMANCE

Presetting at factory for accurate performance eliminates field settings, makes installation of Caterpillar fuel injection pumps quick and simple.

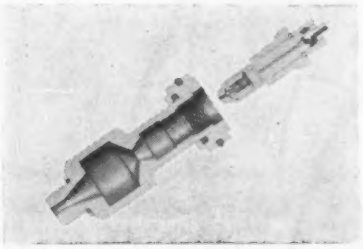
The fuel injection system is a key to peak engine performance. It must deliver to each cylinder equal amounts of fuel at precisely the right time. Deviation means a loss in horsepower. That's why it pays to use Cat fuel injection equipment.

Cat injection equipment can save you money in other ways, too. No field or operating adjustments are necessary. Installation is *quick and simple*. All pumps are interchangeable for different cylinders and between engines of the same model.

This interchangeability permits smaller parts inventories, makes replacement inexpensive by eliminating custom fitting, and makes replacement possible in a matter of *minutes* right on the job regardless of the experience of the mechanic.

Genuine Caterpillar injection equipment is built to last. With clean fuel, a life of 20,000 service meter hours is not unusual.

Pumps, plungers and barrels are manufactured from the finest chromium alloy, so hard that diamond dust is required for lapping the plungers and barrels. Pumps are tested and preset at the factory to provide accurate metering, timing and fuel pressure.



HIGHEST STANDARDS in the industry go into the manufacture of Caterpillar fuel injection equipment. Pump plungers and barrels, for example, are finished to tolerances so fine that the heat from your hand will expand a plunger enough to make it larger than the matching barrel.

SERVICE TIP

Your Caterpillar Dealer has the testing equipment to determine accurately when fuel injection systems parts should be replaced. And testing is the only sure way of knowing.

RUN-IN TESTS—four hours on pumps, two on valves – are conducted on these Caterpillar-built test machines before a pump or valve leaves the factory. Strict testing procedure means perfect performance of genuine Caterpillar injection parts.

Single-orifice fuel injection valves minimize the possibility of clogging or fouling. A spring-loaded plunger within the valve opens by fuel pressure at the proper time for uniform and precise injection. Extra protection is given by a fine-mesh screen. This clean, accurate injection means less down time and lowest fuel cost per unit of power.

Don't risk real damage to your Caterpillar equipment with an improperly functioning fuel injection system. Test systems regularly and replace worn parts with genuine Caterpillar parts. Your Caterpillar Dealer has the full story. See him today. And remember, he stands behind every part he sells.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

Improper fuel injection equipment can be expensive. For instance, if a machine's owning and operating cost is $10 per hour, its total cost in a 2,000-hour season is $20,000. For a 200-horsepower machine that's $100 per horsepower. A poorly functioning fuel injection system which robs the machine of 5% of its horsepower (10 HP) could mean a season loss of $1,000 (10 [HP] x $100). Don't take chances. Standardize on Cat equipment.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Easy Way To Pick Up Important Savings

Picking out the best of these beauties is an easy way for us to save money—for you. For these are the finest industrial diamonds the world produces and they will do things for you that no lesser quality can do.

They cut faster, cut more footage per bit and per carat, yield more salvage and deliver more footage per man-hour and per dollar of rig investment. And, you can easily check this by comparing costs. The lower price tags on the lesser qualities can be a temptation, of course, but it's not the first but the final cost that counts.

The diamonds in Truco bits are painstakingly graded from the largest fine quality stocks on the American Continent.

Any Truco bit can prove to you that there is no substitute for quality.

TRUCO DIAMOND BITS

by

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue, Detroit 38, Michigan

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 Langlois Avenue, Windsor, Ont., Canada

MEMBER Diamond Core Drill Manufacturers Association

3 new applications get longer life and minimum maintenance using Dodge pillow blocks with Timken® bearings

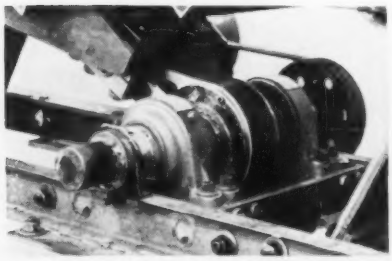
PICTURED below are three applications where Timken bearing equipped Dodge pillow blocks stay on the job with little attention under tough conditions. Their tapered design lets Timken® bearings take *both* radial and thrust loads in any combination. And full-line contact between rollers and races provides extra load-carrying capacity. Wear is reduced, maintenance is cut to the minimum.

Cutaway view shows the Dodge All-Steel pillow block with Timken bearing mounting. Of special design, the bearing has a tapered bore with self-aligning spherical outer surface —never needs adjustment.

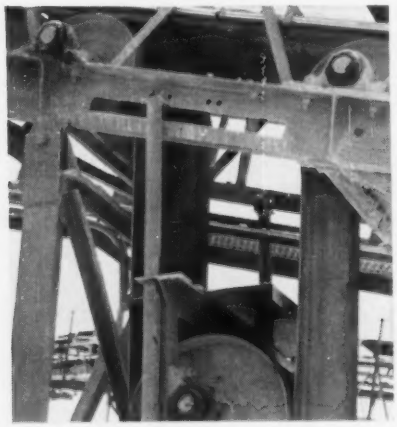
Besides the All-Steel pillow block, other versatile Dodge pillow blocks with Timken tapered roller bearings are: Type "E", Double-Interlock, Type "C" and Special Duty. All are compact in design. Special thrust devices that take up extra space are not needed.

And to get the finest steel for Timken bearings, we make it ourselves—America's only bearing manufacturer that does. So specify bearings trademarked "TIMKEN" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

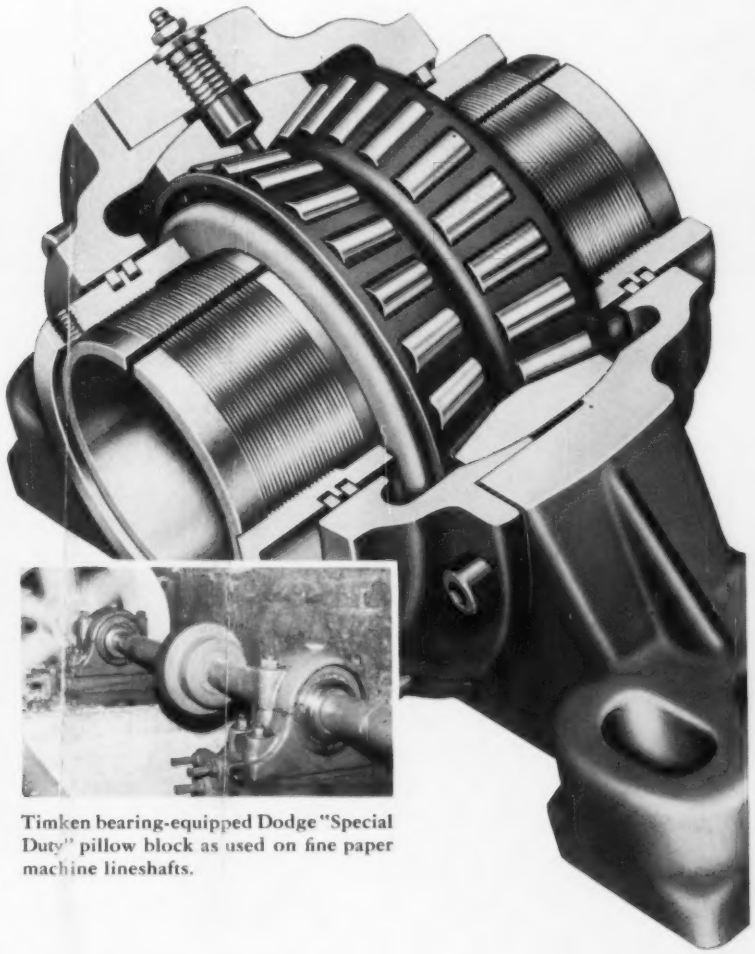
This symbol on a product means its bearings are the best.



Timken bearing-equipped Dodge All-Steel pillow block used in a vibrating conveyor.



Timken bearing-equipped Dodge Type "E" pillow block used in sand and gravel plant.



Timken bearing-equipped Dodge "Special Duty" pillow block as used on fine paper machine lineshafts.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD